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THERMOPHYSICAL PROPERTIES OF MATTER

The TPRC Data Series

VOLUME 1

THERMAL CONDUCTIVITY

Metallic Elements and Alloys

Best Available Copy

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The TPRC Data Series published in 13 volumes plus a Master Index volume constitutes a permanent and valuable contribution to science and technology. This 17,000 page Data Series should form a necessary acquisition to all scientific and technological libraries and laboratories. These volumes contain an enormous amount of data and information for thermophysical properties on more than 5,000 different materials of interest to researchers in government laboratories and the defense industrial establishment.

(continue on reverse side)

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Antimony selenide--Antimony tellurde---iron--arsenic--arsenic telluride--Barium alloys--Beryllium--Beryllium alloys--bismuth--Bismuth alloys--Bismuth compounds--Boron--Boron Silicides--Brass--Cadmium--Cadmium Alloys--Cadmium compounds--Calcium compounds--Cerium--Cermets---Cesium--Chromium--Chromium alloys --Cobalt-- --Cobalt alloys--Columbium--Copper--Copper Alloys--Copper compounds--Gallium--Gallium arsenide--Germanium--Germanium alloys--Germanium telluride--Gold--Gold Alloys--Hafnium--Hafnium alloys--Indium--Indium alloys--Indium compounds--Intermetallic compounds--Iridium--Iridium alloys--Lanthanum--Lanthanum compounds--Lead--Lead alloys--Lead telluride--Lithium--Lithium alloys--Magnesium--Magnesium alloys--Magnesium compounds--Manganese--Manganese alloys--Mercury--Mercury compounds--Molybdenum--Molybdenum alloys--Silicides--Neodymium--Nickel--Nickel alloys--Niobium--Niobium alloys--Palladium--Palladium alloys--Platinum--Platinum alloys--Plutonium--Plutonium alloys--Potassium--Praseodymium--Rhenium--Rhenium compounds--Rhodium--Rubidium--Ruthenium--Steels--Scandium--Selenium--Selenium alloys--Silicon--Silicon alloys--Silver--Silver alloys--Silver compounds--Sodium--Sodium alloys--Tantalum--Tantalum alloys--Tellurium--Tellurium alloys--Terbium--Thallium--Thallium alloys--Thorium--Tin--Tin alloys--Titanium--Titanium alloys--Titanium compounds--Uranium--Uranium alloys--Vanadium--Vanadium alloys--Ytterbium--Yttrium--Zinc--Zinc alloys--Zinc compounds--Zirconium--Zirconium alloys--

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20. ABSTRACT (cont)

Volume 1. 'Thermal Conductivity - Metallic Elements and Alloys,' Touloukian, Y.S., Powell, R.W., Ho, C.Y., and Klemens, P.G., 1595 pp., 1970.

Volume 1 in this 14 volume TPRC Data Series covers metallic elements and alloys and intermetallic compounds of engineering importance, including 69 elements, 172 groups of nonferrous binary alloys, 80 groups of nonferrous multiple alloys, 25 groups of ferrous alloys, 60 intermetallic compounds, 16 mixtures of intermetallic compounds, and 13 miscellaneous alloys and mixtures. Data for all the elements and for some alloys have been critically evaluated, analyzed, and synthesized, and recommended values or provisional values are presented in addition to the original experimental data.

1595 pages, 1970 $130.00 ($156.00 outside US)

THERMAL CONDUCTIVITY

Metallic Elements and Alloys

THERMOPHYSICAL PROPERTIES OF MATTER
VOLUME 1

THERMAL CONDUCTIVITY

Metallic Elements and Alloys

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"In this work, when it shall be found that much is omitted, let it not be forgotten that much likewise is performed..."

SAMUEL JOHNSON, A.M.

From last paragraph of Preface to his two-volume *Dictionary of the English Language*. Vol. I, page 5, 1755, London, Printed by Strahan.

Foreword

In 1957, the Thermophysical Properties Research Center (TPRC) of Purdue University, under the leadership of its founder, Professor Y. S. Touloukian, began to develop a coordinated experimental, theoretical, and literature review program covering a set of properties of great importance to science and technology. Over the years, this program has grown steadily, producing bibliographies, data compilations and recommendations, experimental measurements, and other output. The series of volumes for which these remarks constitute a foreword is one of these many important products. These volumes are a monumental accomplishment in themselves, requiring for their production the combined knowledge and skills of dozens of dedicated specialists. The Thermophysical Properties Research Center deserves the gratitude of every scientist and engineer who uses these compiled data.

The individual nontechnical citizen of the United States has a stake in this work also, for much of the science and technology that contributes to his well-being relies on the use of these data. Indeed, recognition of this importance is indicated by a mere reading of the list of the financial sponsors of the Thermophysical Properties Research Center; leaders of the technical industry of the United States and agencies of the Federal Government are well represented.

Experimental measurements made in a laboratory have many potential applications. They might be used, for example, to check a theory, or to help design a chemical manufacturing plant, or to compute the characteristics of a heat exchanger in a nuclear power plant. The progress of science and technology demands that results be published in the open literature so that others may use them. Fortunately for progress, the useful data in any single field are not scattered throughout the tens of thousands of technical journals published throughout the world. In most fields, fifty percent of the useful work appears in no more than thirty or forty journals. However, in the case of TPRC, its field is so broad that about 100 journals are required to yield fifty percent. But that other fifty percent! It is scattered through more than 3500 journals and other documents, often items not readily identifiable or obtainable. Nearly 50,000 references are now in the files.

Thus, the man who wants to use existing data, rather than make new measurements himself, faces a long and costly task if he wants to assure himself that he has found all the relevant results. More often than not, a search for data stops after one or two results are found--or after the searcher decides he has spent enough time looking. Now with the appearance of these volumes, the scientist or engineer who needs these kinds of data can consider himself very fortunate. He has a single source to turn to; thousands of hours of search time will be saved, innumerable repetitions of measurements will be avoided, and several billions of dollars of investment in research work will have been preserved.

However, the task is not ended with the generation of these volumes. A critical evaluation of much of the data is still needed. Why are discrepant results obtained by different experimentalists? What undetected sources of systematic error may affect some or even all measurements? What value can be derived as a "recommended" figure from the various conflicting values that may be reported? These questions are difficult to answer, requiring the most sophisticated judgment of a specialist in the field. While a number of the volumes in this Series do contain critically evaluated and recommended data, these are still in the minority. The data are now being more intensively evaluated by the staff of TPRC as an integral part of the effort of the National Standard Reference Data System (NSRDS). The task of the National Standard Reference Data System is to organize and operate a comprehensive program to prepare compilations of critically evaluated data on the properties of substances. The NSRDS is administered by the National Bureau of Standards under a directive from the Federal Council for Science and Technology, augmented by special legislation of the Congress of the United States. TPRC is one of the national resources participating in the National Standard Reference Data System in a united effort to satisfy the needs of the technical community for readily accessible, critically evaluated data.

As a representative of the NBS Office of Standard Reference Data, I want to congratulate Professor Touloukian and his colleagues on the accomplishments represented by this Series of reference data books. Scientists and engineers the world over are indebted to them. The task ahead is still an awesome one and I urge the nation's private industries and all concerned Federal agencies to participate in fulfilling this national need of assuring the availability of standard numerical reference data for science and technology.

EDWARD L. BRADY
Associate Director for Information Programs
National Bureau of Standards

Preface

Thermophysical Properties of Matter, the TPRC Data Series, is the culmination of twelve years of pioneering effort in the generation of tables of numerical data for science and technology. It constitutes the restructuring, accompanied by extensive revision and expansion of coverage, of the original *TPRC Data Book*, first released in 1960 in loose-leaf format, 11" × 17" in size, and issued in June and December annually in the form of supplements. The original loose-leaf *Data Book* was organized in three volumes: (1) metallic elements and alloys, (2) nonmetallic elements, compounds, and mixtures which are solid at N.T.P., and (3) nonmetallic elements, compounds, and mixtures which are liquid or gaseous at N.T.P. Within each volume, each property constituted a chapter.

Because of the vast proportions the *Data Book* began to assume over the years of its growth and the greatly increased effort necessary in its maintenance by the user, it was decided in 1967 to change from the loose-leaf format to a conventional publication. Thus, the December 1966 supplement of the original *Data Book* was the last supplement disseminated by TPRC.

While the manifold physical, logistic, and economic advantages of the bound volume over the loose-leaf oversize format are obvious and welcome to all who have used the unwieldy original volumes, the assumption that this work will no longer be kept on a current basis because of its bound format would not be correct. Fully recognizing the need of many important research and development programs which require the latest available information, TPRC has instituted a *Data Update Plan* enabling the subscriber to inquire, by telephone if necessary, for specific information and receive, in many instances, same-day response on any new data processed or revision of published data since the latest edition. In this context, the TPRC Data Series departs drastically from the conventional handbook and giant multivolume classical works, which are no longer adequate media for the dissemination of numerical data of science and technology without a continuing activity on contemporary coverage. The loose-leaf arrangements of many works fully recognize this fact and attempt to develop a combination of bound volumes and loose-leaf supplement arrangements as the work becomes increasingly large. TPRC's *Data Update Plan* is indeed unique in this sense since it maintains the contents of the TPRC Data Series current and live on a day-to-day basis between editions. In this spirit, I strongly urge all purchasers of these volumes to complete in detail and return the *Volume Registration Certificate* which accompanies each volume in order to assure themselves of the continuous receipt of annual listing of corrigenda during the life of the edition.

The TPRC Data Series consists initially of 13 independent volumes. The initial ten volumes will be published in 1970, and the remaining three by 1972. It is also contemplated that subsequent to the first edition, each volume will be revised, updated, and reissued in a new edition approximately every fifth year. The organization of the TPRC Data Series makes each volume a self-contained entity available individually without the need to purchase the entire Series.

The coverage of the specific thermophysical properties represented by this Series constitutes the most comprehensive and authoritative collection of numerical data of its kind for science and technology.

Whenever possible, a uniform format has been used in all volumes, except when variations in presentation were necessitated by the nature of the property or the physical state concerned. In spite of the wealth of data reported in these volumes, it should be recognized that all volumes are not of the same degree of completeness. However, as additional data are processed at TPRC on a continuing basis, subsequent editions will become increasingly more complete and up to date. Each volume in the Series basically comprises three sections, consisting of a text, the body of numerical data with source references, and a material index.

The aim of the textual material is to provide a complementary or supporting role to the body of numerical data rather than to present a treatise on the subject of the property. The user will find a basic theoretical treatment, a comprehensive presentation of selected works which constitute reviews, or compendia of empirical relations useful in estimation of the property when there exists a paucity of data or when data are completely lacking. Established major experimental techniques are also briefly reviewed.

The body of data is the core of each volume and is presented in both graphical and tabular formats for convenience of the user. Every single point of numerical data is fully referenced as to its original source and no secondary sources of information are used in data extraction. In general, it has not been possible to critically scrutinize all the original data presented in these volumes, except to eliminate perpetuation of gross errors. However, in a significant number of cases, such as for the properties of liquids and gases and the thermal conductivity of all the elements, the task of full evaluation, synthesis, and correlation has been completed. It is hoped that in subsequent editions of this continuing work, not only new information will be reported but the critical evaluation will be extended to increasingly broader classes of materials and properties.

The third and final major section of each volume is the material index. This is the key to the volume, enabling the user to exercise full freedom of access to its contents by any choice of substance name or detailed alloy and mixture composition, trade name, synonym, etc. Of particular interest here is the fact that in the case of those properties which are reported in separate companion volumes, the material index in each of the volumes also reports the contents of the other companion volumes.* The sets of companion volumes are as follows:

Thermal conductivity:	Volumes 1, 2, 3
Specific heat:	Volumes 4, 5, 6
Radiative properties:	Volumes 7, 8, 9
Thermal expansion:	Volumes 12, 13

The ultimate aims and functions of TPRC's Data Tables Division are to extract, evaluate, reconcile, correlate, and synthesize all available data for the thermophysical properties of materials with the result of obtaining internally consistent sets of property values, termed the "recommended reference values." In such work, gaps in the data often occur, for ranges of temperature, composition, etc. Whenever feasible, various techniques are used to fill in such missing information, ranging from empirical procedures to detailed theoretical calculations. Such studies are resulting in valuable new estimation methods being developed which have made it possible to estimate values for substances and/or physical conditions presently unmeasured or not amenable to laboratory investigation. Depending on the available information for a particular property and substance, the end product may vary from simple tabulations of isolated values to detailed tabulations with generating equations, plots showing the concordance of the different values, and, in some cases, over a range of parameters presently unexplored in the laboratory.

The TPRC Data Series constitutes a permanent and valuable contribution to science and technology. These constantly growing volumes are invaluable sources of data to engineers and scientists, sources in which a wealth of information heretofore unknown or not readily available has been made accessible. We look forward to continued improvement of both format and contents so that TPRC may serve the scientific and technological community with ever-increasing excellence in the years to come. In this connection, the staff of TPRC is most anxious to receive comments, suggestions, and criticisms from all users of these volumes. An increasing number of colleagues are making available at the earliest possible moment reprints of their papers and reports as well as pertinent information on the more obscure publications. I wish to renew my earnest request that this procedure becomes a universal practice since it will prove to be most helpful in making TPRC's continuing effort more complete and up to date.

It is indeed a pleasure to acknowledge with gratitude the multisource financial assistance received from over fifty of TPRC's sponsors which has made the continued generation of these tables possible. In particular, I wish to single out the sustained major support being received from the Air Force Materials Laboratory–Air Force Systems Command, the Office of Standard Reference Data–National Bureau of Standards, and the Office of Advanced Research and Technology-National Aeronautics and Space Administration. TPRC is indeed proud to have been designated as a National Information Analysis Center for the Department of Defense as well as a component of the National

*For the first edition of the Series, this arrangement was not feasible for Volume 7 due to the sequence and the schedule of its publication. This situation will be resolved in subsequent editions.

Standard Reference Data System under the cognizance of the National Bureau of Standards.

While the preparation and continued maintenance of this work is the responsibility of TPRC's Data Tables Division it would not have been possible without the direct input of TPRC's Scientific Documentation Division and, to a lesser degree, the Theoretical and Experimental Research Divisions. The authors of the various volumes are the senior staff members in responsible charge of the work. It should be clearly understood, however, that many have contributed over the years and their contributions are specifically acknowledged in each volume. I wish to take this opportunity to personally thank those members of the staff, research assistants, graduate research assistants, and supporting graphics and technical typing personnel without whose diligent and painstaking efforts this work could not have materialized.

Y. S. Touloukian

Director
Thermophysical Properties Research Center
Distinguished Atkins Professor of Engineering

Purdue University
Lafayette, Indiana
July 1969

Introduction to Volume 1

This volume of *Thermophysical Properties of Matter*, the TPRC Data Series, is perhaps the most comprehensive of all the volumes of the Series. Indeed, it is the result of one of TPRC's oldest data tables programs, initiated in 1959.

The volume comprises three major sections: namely, the front text material together with its bibliography, the main body of numerical data and its references, and the material index.

The text material is intended to assume a role complementary to the main body of numerical data which is the primary purpose of this volume. It is felt that a moderately detailed discussion of the theoretical nature of the property under consideration together with a review of predictive procedures and recognized experimental techniques will be appropriate in a major reference work of this kind. The extensive reference citations given in the text should lead the interested reader to sufficient literature for a detailed study. It is hoped, however, that enough detail is presented for this volume to be self-contained for the practical user.

The main body of the volume consists of the presentation of numerical data compiled over the years in a most comprehensive and meticulous manner. The scope of coverage includes the metallic elements and most metallic alloys and intermetallic compounds of engineering importance. The extraction of all data directly from their original sources ensures freedom from errors of transcription. Furthermore, some gross errors appearing in the original source documents have been corrected. The organization and presentation of the data together with other pertinent information in the use of the tables and figures are discussed in detail in the section entitled *Numerical Data.*

The part of the data tables covering the elements deserves special mention. We wish to point out that the extensive original literature data from near absolute zero to past the melting point have been critically reviewed and analyzed, and "recommended reference values" are presented.

Such recommended values are those that were considered to be the most probable when assessments were made of the information available in late 1968. Their inclusion adds a unique feature that is designed to provide the user with acceptable values. It should be realized, however, that these recommended values are not necessarily the final true values and that changes directed toward this end will often become necessary as more data become available. Future editions will contain these changes and will provide similar recommendations made for an increasing number of materials.

As stated earlier, all data have been obtained from their original sources and each data set is so referenced. TPRC has in its files all documents cited in this volume. Those that cannot readily be obtained elsewhere are available from TPRC in microfiche form.

The material index at the end of the volume covers the contents of all three companion volumes (Volumes 1, 2, and 3) on thermal conductivity. It is hoped that the user will find these comprehensive indices helpful.

This volume has grown out of activities made possible, initially by TPRC's Founder Sponsors, and, since 1960, through the principal support of the Air Force Materials Laboratory—Air Force Systems Command, under the monitorship of Mr. John H. Charlesworth. The effort to make critical assessment of the data for the elements was made possible through the support of the Office of Standard Reference Data—National Bureau of Standards, under the monitorship of Dr. Howard J. White, Jr. Over the past ten years, many graduate students and research assistants have rendered assistance for varying periods under the authors' supervision. We wish to acknowledge in chronological order of their association with TPRC, the contributions of Messrs. K. H. Chu, C. Y. Wang, A. Cezairliyan, K. C. Lin, D. Y. Nee, R. L. Feng, J. J. G. Hsia, M. Mangkornkanok, M. Nalbantyan, G. K. Kirjilian, and Mrs. E. K. C. Lee, and Mr. K. Y. Wu. The

two last mentioned are still at TPRC and participated in the final organization of the tables and figures and the demanding task of checking of details. We wish also to acknowledge the benefit of extensive discussions with Dr. J. Kaspar, Senior Staff Scientist, Materials Sciences Laboratory, Aerospace Corporation, and with Dr. A. Cezairliyan, Physicist, National Bureau of Standards. They are, respectively, Visiting Research Professor and Consultant at TPRC.

Inherent to the character of this work is the fact that in the preparation of this volume, we have drawn most heavily upon the scientific literature and feel a debt of gratitude to the authors of the referenced articles. While their often discordant results have caused us much difficulty in reconciling their findings, we consider this to be our challenge and our contribution to negative entropy of information, as an effort is made to create from the randomly distributed data a condensed, more orderly state.

While this volume is primarily intended as a reference work for the designer, researcher, experimentalist, and theoretician, the teacher at the graduate level may also use it as a teaching tool to point out to his students the topography of the state of knowledge on the thermal conductivity of metals. We believe there is also much food for reflection by the specialist and the academician concerning the meaning of "original" investigation and its "information content."

The authors and their contributing associates are keenly aware of the possibility of many weaknesses in a work of this scope. We hope that we will not be judged too harshly and that we will receive the benefit of suggestions regarding references omitted, additional material groups needing more detailed treatment, improvements in presentation or in recommended values, and, most important, any inadvertent errors. If the *Volume Registration Certificate* accompanying this volume is returned, the reader will assure himself of receiving annually a list of corrigenda as possible errors come to our attention.

Lafayette, Indiana
July 1969

Y. S. Touloukian
R. W. Powell
C. Y. Ho
P. G. Klemens

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Numerical Data

Material Index

GROUPING OF MATERIALS AND LIST OF FIGURES AND TABLES

1. ELEMENTS

*Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

1. ELEMENTS (continued)

2. NONFERROUS BINARY ALLOYS

* Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

2. NONFERROUS BINARY ALLOYS (continued)

2. NONFERROUS BINARY ALLOYS (continued)

* Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

2. NONFERROUS BINARY ALLOYS (continued)

2. NONFERROUS BINARY ALLOYS (continued)

3. NONFERROUS MULTIPLE ALLOYS

3. NONFERROUS MULTIPLE ALLOYS (continued)

* Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

3. NONFERROUS MULTIPLE ALLOYS (continued)

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C. ALLOY STEELS

* Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

4. FERROUS ALLOYS (continued)

5. INTERMETALLIC COMPOUNDS

5. INTERMETALLIC COMPOUNDS (continued)

6. MIXTURES OF INTERMETALLIC COMPOUNDS

6. MIXTURES OF INTERMETALLIC COMPOUNDS (continued)

7. MISCELLANEOUS ALLOYS AND MIXTURES

Theory, Estimation, and Measurement

Notation

A	Cross-sectional area
a	Cube root of the atomic volume; Half the focal length of an ellipsoid; Axis of ellipse
B	Coefficient of equation (19)
b	Axis of ellipse; Numerical constant
C	Specific heat per unit volume
$C(\nu)$	Spectral specific heat
c	Atomic concentration of point defects
D	Thermal diffusivity; Coefficient of equation (19)
E	Energy; Voltage drop
e	Electronic charge
G	Band gap energy
h	Planck constant
I	Electric current
k	Thermal conductivity
k_m	Thermal conductivity maximum
k_r	Thermal conductivity of a reference material
L_0	Lorenz number
l	Mean free path; Effective length of a specimen
M	Atomic mass
m	Constant
N	Number of atoms per unit volume
N_a	Number of conduction electrons per atom
n	Exponent; Constant
P	Slope
q	Heat flow per unit time (and length)
r	Radial distance
S	Seebeck coefficient
T	Temperature
T_c	Superconducting transition temperature
T_m	Temperature corresponding to thermal conductivity maximum
ΔT	Temperature difference
t	Time
U	Coefficient of equation (24)
V	Electrical potential
v	Velocity
W	Thermal resistivity
W_∞	Theoretical constant thermal conductivity at high temperature
x	Reduced frequency ($x = h\nu/\kappa T$)
Δx	Distance difference
α	Parameter
α', α''	Constants
β	Parameter
γ	Anharmonicity coefficient
δ	Amplitude decrement of temperature wave; Coefficient of equation (11)
ϵ	Local thermal strain
ζ	Fermi energy
θ	Debye temperature
κ	Boltzmann constant
λ	Wavelength
λ_m	Minimum wavelength
ν	Frequency
ν_m	Debye limiting cutoff frequency
π	Peltier coefficient; Ratio of the circumference of a circle to its diameter
ρ	Electrical resistivity
σ	Electrical conductivity

Subscripts

d	Dislocation
e	Electronic component
ee	Electron–electron scattering
g	Lattice component
gd	Lattice component due to the scattering of phonons by dislocations
ge	Lattice component due to the scattering of phonons by electrons
gp	Lattice component due to the scattering of phonons by point defects
i	Intrinsic
j	Type of carrier
n	Normal state
p	Phonon
pe	Phonon–electron scattering
RT	Room temperature
s	Superconducting state
U	Umklapp process
α	Type of scattering process
0	Residual
1, 2, 3, . . .	Locations, times, or materials

Theory of Thermal Conductivity of Metallic Materials

1. INTRODUCTION

Heat in solids is conducted by various carriers: electrons, lattice waves (or phonons), magnetic excitations, and, in some cases, electromagnetic radiation. The total thermal conductivity is additively composed of contributions from each type of carrier. It can be shown that

$$k = \frac{1}{3}\sum_j C_j v_j l_j \tag{1}$$

where the subscript j denotes the type of carrier, C_j is the contribution of carriers of type j to the specific heat per unit volume, v_j is the velocity of the carrier (we regard the carrier as a particle; if the carrier is a wave, the appropriate velocity is the group velocity), and l_j is a suitably defined mean free path.

The theory of thermal conductivity of solids has been the subject of numerous investigations and several review articles and has constituted a large portion of the material in several books [1-15]. It is the purpose of this introductory text to present the major results of the theory only to the extent to which it is needed by the user of these tables: to caution him as to which results are likely to be structure sensitive and thus likely to vary from specimen to specimen, and to help him to judge which materials are likely to have similar properties and thus to guide him in guessing the thermal conductivities of materials which have not been measured.

The occurrence of a mean free path in equation (1) opens up the possibility that in some cases one cannot uniquely define the thermal conductivity of a material. This happens whenever a carrier mean free path becomes comparable to the smallest external dimension of the specimen. It happens particularly in insulators at low temperatures, because of long phonon mean free paths, and in transparent solids at high temperatures, where photons contribute significantly to heat transport. In metals it is a relatively rare occurrence, to be considered only in the case of very small particles, very thin wires, or superconductors at extremely low temperatures.

The principal carriers of heat in metals are electrons and lattice waves, leading to an overall thermal conductivity

$$k = k_e + k_g \tag{2}$$

where k_e is the electronic component and k_g the lattice component.

Generally k_g of metals, alloys, and semimetals is of magnitude comparable to the lattice thermal conductivity of insulators of corresponding elastic properties, except at low temperatures (where phonon–electron interaction reduces k_g in metals). The relative importance of k_e and k_g thus depends on the magnitude of k_e. The electronic component often parallels the electrical conductivity (Wiedemann–Franz law), and the electrical conductivity is highest in pure metals, reduced in the case of alloys, and even lower in semimetals and semiconductors.

We thus have, as a rough rule, that in highly conducting metals, i.e., pure metals with room temperature resistivities of up to say 5 $\mu\Omega$ cm, k_e is the dominant component over all or almost all temperatures. For poorly conducting metals of higher resistivity, k_g forms an appreciable component at ordinary temperatures. For alloys of more than 0.5 to 1 percent solute content, k_e is substantially decreased below the value of the parent metal at low temperatures (i.e., below room temperature) where k_g becomes significant, but at higher temperatures k_e approaches the value of pure metals of comparable conductivity. Thus k_g is an important component of alloys below room temperatures; above room temperatures it is important when the parent metal is a poor conductor.

As we consider materials of increasingly poorer conductivity, k_e becomes less important relative to

k_g. In semimetals and degenerate semiconductors k_g and k_e are frequently comparable except at low temperatures, where k_e is small. In most semiconductors the electronic thermal conductivity has to be considered only at elevated temperatures.

Since k_e and k_g behave differently as functions of temperature and with the introduction of imperfections, it is important to know the relative roles of these two carriers if predictions are to be made; unfortunately, it is not always easy to know what fraction of the measured thermal conductivity can be ascribed to each (see, for example, reference [1]).

For purposes of the theory of conduction properties, we distinguish between three temperature regimes: high, intermediate, and low, with rough divisions at temperatures (on the absolute scale) of θ and $\theta/3$ respectively, where θ is the Debye temperature. For our purposes this temperature is related to the upper frequency limit ν_m of the spectrum of lattice waves by $h\nu_m = \kappa\theta$, where h and κ are the Planck and Boltzmann constants, respectively. Roughly speaking, at high temperatures each atom vibrates independently of its neighbors, and the theories of lattice vibration simplify. At low temperatures the vibrations are highly correlated and are best described by elastic waves in a continuum with corresponding simplification. The intermediate regime is somewhat awkward, and theoretical results are obtained by interpolation.

All the carriers have mean free paths which are limited in part by the structural imperfections of the solid and in part by the dynamic imperfections produced by thermal vibrations, so that, for each carrier,

$$1/l = \sum_{(\alpha)} 1/l_{(\alpha)} \tag{3}$$

the summation being over all processes α which scatter the carrier. The theory describing scattering by the thermal vibrations depends on the temperature regime, and this accounts for the different theories to be used for the conduction properties.

Most solids have Debye temperatures θ around 300 K, but atomically heavy solids have lower θ's (well below 200 K for gold and lead), while most light-atom solids (diamond, beryllium) have much higher Debye temperatures.

2. ELECTRONIC THERMAL CONDUCTIVITY

In metals, where the density of electrons is high, the electron gas is highly degenerate, that is, all electron states of energy $E < \zeta$ are filled, ζ being the Fermi energy, all states of $E > \zeta$ are empty, and all conduction properties occur in an energy interval $\zeta \pm 0(\kappa T)$, where $\kappa T \ll \zeta$. Under these circumstances the electronic component of the specific heat $C_e \propto T$. v_e is typically 10^8 cm sec^{-1} and independen of temperature. Thus

$$k_e = \tfrac{1}{3} C_e v_e l_e \propto T l_e \tag{4}$$

and its temperature dependence is governed by the temperature dependence of l_e.

Now the electron mean free path l_e also determines the electrical conductivity. Theories of the electron mean free paths are thus at the same time theories of the electrical conductivity σ of metals, while the thermal and the electrical conductivity are related by the Wiedemann–Franz–Lorenz law

$$k_e/\sigma T = L_0 = \tfrac{1}{3}\pi^2(\kappa/e)^2 \tag{5}$$

where e is the electronic charge. In practical units the Lorenz number L_0 is 2.443×10^{-8} V^2 K^{-2}.

The electron mean free path is limited both by electron scattering by defects (chemical impurities and physical defects) and by the thermal vibrations; for in a perfectly periodic crystal lattice l_e would be infinite. To the extent to which the scattering rates due to different processes are additive,

$$1/l_e = 1/l_0 + 1/l_i(T) \tag{6}$$

where l_0 is the residual mean free path and $l_i(T)$ the intrinsic mean free path. The first term on the right hand side of equation (6) describes scattering of electrons by defects, and varies from specimen to specimen, but is independent of temperature as long as the nature and concentration of defects are not functions of temperature.* The second term describes scattering of electrons by lattice vibrations and varies with temperature. In the simple case when the electron gas is isotropic, i.e., the velocity and apparent density of electrons do not depend upon direction relative to the crystal axes, equation (6) leads to an additivity of the co[illegible]onding electrical and electronic thermal resistivitie[illegible] i.e.,

$$1/\sigma = \rho = \rho_0 + \rho_i(T) \tag{7}$$

and

$$1/k_e = W_e = W_0 + W_i \tag{8}$$

*An important exception would be the vacancy concentration just below the melting point, which in some metals depends on temperature.

Here ρ_0 is the residual electrical resistivity, varying from specimen to specimen, $\rho_i(T)$ the intrinsic electrical resistivity, and W_0, W_i are corresponding components of the thermal resistivity.

The Wiedemann–Franz–Lorenz law, equation (5), is based on the following requirements:

(a) The electron gas is highly degenerate—this appears to be the case in all metals except possibly some transition metals at elevated temperatures.

(b) The electron mean free path l_e is the same for electrical as for thermal conduction, so that it cancels in the ratio k/σ.

An analysis of the second requirement shows that this is almost always satisfied for defect scattering [1, 2]; hence

$$\rho_0/W_0T = L_0 \tag{9}$$

The exceptions are some cases of magnetic impurities, where scattering is simultaneously inelastic and anisotropic; even here the departure from (9) is significant only at low temperature, where κT is comparable to the Zeeman level splitting of the impurity.

As regards ρ_i and W_i, these are related by the Wiedemann–Franz–Lorenz law in the high-temperature limit only, while at lower temperatures

$$\rho_i/W_iT = L_i \tag{10}$$

is generally less than L_0 for reasons given in reference [2]. Generally $L_i < L_0$ and in the limit of low temperatures

$$L_i = \delta(T/\theta)^2 \tag{11}$$

where the coefficient δ depends on the topology of the Fermi surface.

Explicit theoretical expressions for ρ_i and W_i have been obtained only for the very simplest of models, with the electron gas similar to a gas of free electrons, with spherical energy contours in momentum space, and the underlying crystal structure replaced by a uniform distribution of positive charge to compensate the charge of the electron gas. This model, the "jellium" model [12], thus foregoes any considerations of effects due to crystal structure and the corresponding electronic band structure of real metals. On such a model, using a Debye model for the spectrum of lattice vibrations, one obtains the following low-temperature limits [2]

$$\rho_i \propto T^5, \qquad W_i \propto T^2 \tag{12}$$

and

$$L_i = \rho_i/W_iT = 7.8\ N_a^{-2/3}(T/\theta)^2 \tag{13}$$

where N_a is the number of conduction electrons per atom. The electronic thermal resistivity at low temperatures can thus be written in the form

$$W_e = \alpha T^2 + \beta/T \tag{14}$$

Thus

$$k_e = \frac{1}{\alpha T^2 + \beta/T} \tag{15}$$

where $\beta = \rho_0/L_0$ depends on the specimen, while α is an intrinsic property of the metal. Equation (15) implies that k_e, and thus the total thermal conductivity of pure metals, should pass through a maximum at low temperatures; the purer the specimen, the higher the maximum conductivity and the lower the temperature at which the maximum occurs.

In order to predict theoretically the magnitude of α, or the magnitude of ρ_i, one would need to predict the strength of the interaction between electrons and lattice waves and the corresponding electron scattering probabilities. This interaction can only be estimated very roughly.

In a similar manner, the ability of fundamental theory to predict the absolute magnitude of β for a given concentration of impurities or other defects is very limited. Since such calculations also predict ρ_0, and since electrical resistivities are measured more readily than thermal conductivities, such calculations are usually classified under electrical resistivity calculations. There is an extensive literature on this subject [12], dealing both with theoretical methods and with the vexing question of determining from experiments the specific resistivity of a given number of physical defects of various kinds (i.e., vacancies, interstitials, dislocations, stacking faults) [16]. Even the specific resistivity (or ρ_0 per atomic percent) of a given species of solute atoms is not a trivial determination.

Generally speaking the theory is well able to predict ρ_0 due to point defects which scatter electrons mainly by virtue of a valence difference (vacancies, solute atoms), but does poorly when distortion effects are important (interstitials, dislocations).

The theoretical equation (15) has been extensively compared with low-temperature experimental data for high-purity metals, and disagreements are found [55–57] in that the power of T for most metals is not 2 but greater, and the coefficient α is not a constant for a metal. Considering the temperature dependence of the coefficient α and the interaction between intrinsic and residual thermal resistivities, equation (15) is modified semiempirically [55–57] to become

$$k_e = \frac{1}{\alpha' T^n + \beta/T} \tag{16}$$

where

$$\alpha' = \alpha''\left(\frac{\beta}{n\alpha''}\right)^{(m-n)/(m+1)}$$

and α'', m, and n are constants for a metal. The value of n lies between 2 and 3 for most metals. Much better agreements are obtained in using equation (16) for fitting experimental data, and this equation has been used extensively for calculating the recommended values presented in this volume for highly conducting elements at temperatures below about 1.5 T_m, with T_m the temperature corresponding to the maximum conductivity k_m of the curve.

At high temperatures the theory becomes simpler in form, though it is still difficult to predict absolute values. The theory predicts in the limit, well above the Debye temperature,

$$\rho_i \propto T$$
$$W_i = \rho_i/L_0 T = W_\infty \tag{17}$$

where W_∞ is a constant. This is essentially a consequence of the fact that, at high temperatures the intrinsic scattering probability, or $1/l_i(T)$, varies as $\langle\epsilon^2\rangle$, the mean square thermal strain, which in turn varies as T.

All this needs qualification if finer details are to be investigated. Thus, for example, thermal expansion as well as high-order interactions might cause deviations from $l_i \propto T^{-1}$, and corresponding deviations of W_i from constancy. There are further deviations of L_i from L_0 at high temperatures, generally small but not entirely negligible, arising from the transport equations [12]. Thus $W_i(T)$ tending to a constant value is a good picture only to a first approximation. Finally the assumption of high degeneracy, i.e., $\kappa T \ll \zeta$, which is required so that $\rho \propto 1/l$ and $W \propto T/l$, becomes questionable in some metals at elevated temperatures (i.e., transition metals, actinides), while in the simpler metals we believe it to be a good assumption right up to the melting point.

Finally, the fact that scattering of electrons by thermal vibrations is proportional to $\langle\epsilon^2\rangle$ enables us to estimate the order of magnitude of point defect scattering in terms of thermal scattering at room temperatures, and thus to estimate ρ_0 and W_0 in terms of the room temperature values of ρ_i and W_i. At room temperature $\langle\epsilon^2\rangle$ is about 0.01 in most solids (depending somewhat on atomic volumes and elastic constants, which are not very variable). If we arbitrarily ascribe scattering by a point defect to be equivalent to unit shear strain over one atomic volume, we find that

$$\rho_0 \simeq (\rho_i)_{RT} c$$
$$W_0 T \simeq (W_i)_{RT} c T_{RT} \tag{18}$$

where $(\rho_i)_{RT}$, $(W_i)_{RT}$ are the room temperature intrinsic resistivities, $T_{RT} \simeq 300$ K, and c is the atomic concentration of point defects in percent. Actual values of ρ_0 and $W_0 T$ deviate from the estimates of equation (18) by factors of up to about 3 either way, but equation (18) is very useful in estimating resistivities due to unknown point defects, and applies to all metals and semimetals irrespective of the details of the band structure.

In addition to the scattering of electrons by defect and by thermal vibrations, it is also possible for the electrons to scatter each other, producing both an electrical and thermal resistivity. These effects seem important mainly in metals of high density of states such as transition metals, and lead to resistivities of the form

$$\rho_{ee} \simeq BT^2$$
$$W_{ee} \simeq DT \tag{19}$$

These effects are thus generally important at low temperatures, where they tend to dominate over the respectively T^5 and T^2 variation of ρ_i and W_i, provided of course that the samples are pure enough so that the residual resistivities ρ_0 and W_0 do not yet dominate at those low temperatures. As transition metals are obtained in increasingly pure form, the need of additional terms of the form (19) in the electrical and thermal resistivity equations is found in more and more cases.

Major results of the theory of electronic thermal conductivity have been briefly presented as above. For detailed theoretical developments and discussions, the reader is referred to the review papers and books cited before and to other papers on this subject [17–66].

3. LATTICE THERMAL CONDUCTIVITY

The thermal vibrations of solids contribute to the thermal conductivity. In insulators this is the only mechanism of heat transport except at elevated temperatures. The theory as it applies to insulators is described in somewhat greater detail in Volume 2. The lattice thermal conductivity of metals is governed by the same theoretical considerations, but a number of cases which occur in insulators are not relevant to metals, so that the present discussion is not as comprehensive. General reviews of lattice thermal conductivity are given in references [1-4]. Individual research papers on the theory of lattice thermal conductivity include [67-132].

The thermal vibrations of a perfect crystal are described in terms of lattice waves which occupy a spectrum of frequencies from the lowest frequencies to some upper limit, ν_m, of the order of 10^{13} Hz. At low frequencies these waves are identical to the elastic waves in the corresponding elastic continuum; at the higher frequencies the atomic structure of the crystal lattice leads to dispersion effects. The corresponding wavelengths range from long waves down to waves of length comparable to the interatomic distances.

These waves are randomly excited in thermal equilibrium and the energy content of the solid is given in terms of the laws of statistical mechanics. The specific heat of solids varies as T^3 at the lowest temperatures and is independent of temperature in the high-temperature regime ($T > \theta$, where $\theta = h\nu_m/\kappa$). The spectral distribution of the specific heat per unit volume as given, to a first approximation, by the Debye theory, is of the form

$$C(\nu)\,d\nu = 9N\kappa\left(\frac{T}{\theta}\right)^3 \frac{x^4 e^x}{(e^x - 1)^2}\,dx \qquad (20)$$

where $x = h\nu/\kappa T$ is a reduced frequency and N the number of atoms per unit volume. This holds for $\nu < \nu_m$; for $\nu > \nu_m$, $C(\nu) = 0$.

The Debye approximation disregards the dispersion of the high-frequency lattice waves, disregards differences of polarization of different lattice waves, and smears out the crystal structure of the solid. The only concession to the discreteness of the lattice is the choice of the cutoff frequency ν_m or the corresponding minimum wavelength $\lambda_m = v\nu_m$, where v is some average sound velocity. It is chosen so that the total number of waves corresponds to the correct number of normal modes ($3N$) which this assembly of N atoms ought to have.

In spite of the obvious inadequacy of the Debye approximation, it is frequently chosen as the basis of discussing thermal conductivity, because the inadequacy of that theory is such that small errors in the theory of the specific heat are usually not too important.

In a perfectly periodic crystal which also obeys perfectly the laws of linear elasticity or Hooke's law (i.e., all restoring forces are linear functions of relative displacements, the elastic energy is a quadratic function of relative displacements), each elastic wave is completely independent of all other elastic waves and maintains forever whatever energy it possesses. Such a crystal could carry a heat current or net flow of elastic energy without a driving force, and would thus have an infinite thermal conductivity.

Real crystals, by virtue of structural defects and deviations from linear elasticity, have lattice waves which continuously interchange energy with each other, so that each lattice wave has a finite mean free path. From equation (1), generalized to take account of the fact that this mean free path $l(\nu)$ is generally a function of the frequency of the lattice wave, ν, the lattice thermal conductivity becomes

$$k_g = \frac{1}{3}\int_0^{\nu_m} C(\nu)v_g l(\nu)\,d\nu \qquad (21)$$

where $v_g = d\nu/d(1/\lambda)$ is the group velocity of the waves, and $C(\nu)$ is the spectral specific heat, given approximately by (20).

The lattice thermal conductivity is thus governed by the mean free path of the lattice waves, in an analogous manner to the electronic conduction properties which are governed by the electron mean free path.

Each individual wave can be regarded as a normal mode (or almost normal mode, if l is finite) of the crystal, and obeys the dynamical equations of a harmonic oscillator. According to the laws of quantum mechanics, the energy of each oscillator is not continuously variable, but an integral number of quanta, each of energy $h\nu$. In fact, this was included in the statistical mechanics leading to (20). Each quantum of energy is called a phonon, and each lattice wave contains an integral number of such phonons. By focusing attention on the phonons, as if they were particles, one can describe the thermal energy of vibration of a crystal as a gas of phonons, and use the concepts of the kinetic theory of gases. This description is completely equivalent to the description in terms of lattice waves, and also leads to (21); it has certain advantages of ease of conceptualization, particularly when we talk of the processes of energy interchange between different waves, which can be regarded as scattering of phonons from one wave into another, or the breaking up of a phonon into other phonons, etc. The final results are equivalent, and the phonon mean free path $l(\nu)$ can be defined in an equivalent manner. We shall use either description according to convenience.

At elevated temperatures in good crystals, the principal process limiting the mean free path is the interchange of energy, or scattering of phonons, due to departures from Hooke's law. A local strain ϵ introduces a fractional change in local sound velocity of $\gamma\epsilon$, where the coefficient γ, a measure of the anharmonicity, is of order unity (frequently $\gamma \simeq 2$). At high temperatures the thermal strain at neighboring atomic sites is almost uncorrelated, and scattering is proportional to $\langle\epsilon^2\rangle$ and, in turn, proportional to T. Thus the intrinsic mean free path varies as

$$l_i \propto 1/T \qquad (22)$$

analogously to the similar variation of the electron mean free path [see equation (17)]. This has been pointed out by Debye [67].

There is an important difference, however. The electrons contributing to the conductivity all have a short wavelength, but the lattice waves have a continuous spectrum of wavelengths. A perturbed atomic site, acting as an independent scattering source, would scatter long-wave lattice waves very weakly, and $l(\nu)$ would increase so rapidly with decreasing ν that the thermal conductivity integral, equation (21), would diverge at the low-frequency limit. In fact this model would lead to $l_i(\nu) \propto 1/\nu^4$, and since $C(\nu) \propto \nu^2$ at lowest frequencies [see equation (20)], one can readily appreciate the divergence difficulty. This simple model is thus inadequate at low frequencies. To avoid this difficulty, Peierls [68] set up a theory of the anharmonic interaction between lattice waves, which is the basis of all subsequent theoretical work. The theory resolves the thermal vibrations into their proper spectral components of lattice waves, and treats in detail the interchange of energy between groups of three lattice waves, or breaking up of one phonon into two other phonons (or vice versa), satisfying certain interference conditions between the frequencies and the direction and wavelengths involved. The theory leads, with some approximation, to a variation

$$1/l_i \propto \nu^2 T \qquad (23)$$

and avoids the divergence difficulties [3].

In detail, however, the theory is quite complicated, involving not only the strength of the anharmonic interaction γ, which cannot be estimated with accuracy, but also the detailed crystal structure. (An elastic continuum would not have a thermal resistivity.) Nevertheless, rough estimates have been made [3, 79] and the intrinsic thermal resistivity of the lattice component is of the form

$$W_U \simeq U\left(\frac{h}{\kappa}\right)^3 \frac{\gamma^2}{Ma}\frac{T}{\theta^3} \qquad (24)$$

where M is the atomic mass and a^3 the atomic volume. The numerical coefficient U, typically of order 1/3, is somewhat uncertain, and depends on the details of the crystal structure. The major factor controlling the intrinsic lattice conductivity, however, is the Debye temperature. Solids of high θ will generally have higher values of k_t.

The subscript U stands for *Umklapp*, or flip-over; in Peierls' theory the resistive processes are processes in which the phonon interaction is combined with a Bragg reflection of the lattice wave, or Umklapp processes. These are distinct from the "normal" processes, phonon interactions which help establish thermal equilibrium, but do not change the net energy flow associated with the phonon gas. The need to distinguish between these processes and their different role in producing thermal resistivity adds further complexity to the theory, particularly at intermediate temperatures, and makes detailed numerical predictions very difficult.

At low temperatures the thermal resistivity decreases exponentially according to $W_U \propto e^{-\theta/bT}$, where b is a numerical constant, which also depends sensitively on the crystal structure and the dispersion of the high-frequency lattice waves. This exponential temperature variation has been observed in perfect insulators, but in many insulators it is overshadowed by the thermal resistance which arises from the scattering of lattice waves by various defects.

In metals, however, another resistive process usually dominates at low temperatures: scattering of the lattice waves or phonons by the free electrons. This is of course the very same process as the scattering of conduction electrons by lattice waves or thermal vibrations which had been invoked earlier to limit the electronic conduction properties and which gave rise to $\rho_i(T)$ and $W_i(T)$. These interactions limit the phonon mean free path; the corresponding reciprocal mean free path for phonon–electron scattering

$$1/l_{pe}(\nu) \propto \nu \tag{25}$$

must be added to the other scattering processes according to equation (3) to obtain $l(\nu)$ of equation (21).

The result of this scattering mechanism is that k_g of metals is lower than k_g of insulating crystals of the same elastic properties, particularly at low temperatures, where $k_g \propto T^2$. At high temperatures, however, anharmonic resistive processes dominate, and k_g tends to equal $1/W_U$ and thus varies as $1/T$. The lattice conductivity will thus have some maximum value at intermediate temperatures. This maximum value is usually considerably smaller than that of insulating crystals, and also smaller than k_e of most pure metals. Typical values of k_g at its maximum (which may lie between 20 and 50 K) would not exceed 0.5 W cm^{-1} K^{-1}, while k_e of metals and k_g of insulators may peak at values ranging from tens to hundreds of watt-units.

Equation (25) was based on the assumption that the electrons have such a long mean free path that the lattice wave can interact with individual electrons. If l' is the electron mean free path, this is equivalent to requiring that

$$l' > \lambda \tag{26}$$

where λ is the wavelength of the lattice wave (or phonon). In alloys, where l' is finite, this relation breaks down for sufficiently long waves, i.e., at sufficiently low temperatures. With l' typically $100a$ for 1 percent impurity and $\lambda \simeq \frac{1}{3}a(\theta/T)$ for the important thermal waves, where a^3 is the atomic volume, equation (26) is barely satisfied at liquid helium temperatures for a 1 percent alloy (a typical minimum concentration at which k_g can still be separated from k and studied).

In the opposite extreme ($l' \ll \lambda$), the lattice wave no longer interacts with individual electrons, but with the electron gas as a whole [83]. The scattering is no longer given by equation (25), but reduced by a factor of order (l'/λ), so that $1/l_{pe}(\nu) \propto \nu^2$ and $k_g \propto T$ instead of T^2, and appropriately increased. This changed temperature dependence is clearly seen in concentrated alloys of $\rho_0 > 10\ \mu\Omega$ cm. But even in more dilute alloys the effect is partially present at liquid helium temperatures and should be more apparent at lower temperatures. A theoretical analysis of these intermediate situations and a comparison with data for the lattice component of alloys has been given by Lindenfeld and Pennebaker [105].

Finally we must consider the scattering of lattice waves by crystal defects or imperfections.

As a rough rule we can state that extended defects contribute to the lattice thermal resistivity, $1/k_g$, most importantly at lowest temperatures (long waves), while point defects make their most important contribution to $1/k_g$ at intermediate temperatures (at temperatures at or above the maximum in k_g).

At low temperatures the frequency dependence of the phonon mean free path is reflected in the temperature dependence of the lattice conductivity. This is readily seen from equation (21), using expression (20) for $C(\nu)$. If $l(\nu) \propto \nu^{-n} \propto T^{-n}x^{-n}$,

$$k_g \propto T^{3-n} \tag{27}$$

One can show (e.g., reference [3]) that the frequency dependence of $l(\nu)$ depends on the geometry of the imperfections. For point defects $n = 4$, for line defects $n = 3$, and for sheets $n = 2$. Dislocations have a long-range strain field which is responsible for most of the scattering; for dislocations $n = 1$. The additional scattering by the core has a frequency dependence $n = 3$, but it is only a minor component.

At lowest temperatures dislocations are generally the most important imperfections scattering phonons. Since the frequency dependence is the same as that for scattering by electrons, these two resistive processes are additive, so that

$$\frac{1}{k_g} = W_g = W_{ge} + W_{gd} \propto T^{-2} \tag{28}$$

where W_{ge} is the lattice resistivity due to electrons, and W_{gd} is that due to dislocations. Typically, W_{gd} becomes comparable to W_{ge} for dislocation densities of the order of 10^{10} per cm^2. The lattice thermal conductivity of alloys is thus sensitive to the state of cold work, even though cold work in alloys produces only small fractional changes in ρ_0 and thus only small changes in k_e.

Relation (27) does not hold, strictly speaking, for point defects, where $n = 4$, for if $l \propto 1/\nu^4$ the integral (21) diverges at low frequencies, though the resulting resistivity frequently is of the form $W_{gp} \propto T$. Point defects must always be considered in conjunction with another resistive process—in conjunction with electron scattering at low temperatures, in conjunction with anharmonic interactions at high temperatures, and the corresponding integrals (21) can only be evaluated numerically.

At low temperatures point defects lead to a departure from $k_g \propto T^2$, which becomes progressively larger as the temperature is increased. Around the maximum of k_g they depress the maximum and tend to flatten the curve, and at even higher temperatures they depress the conductivity and lead to a temperature dependence slower than T^{-1}. As a consequence of the properties of equation (21), their resistivity effect increases more slowly than linearly with point defect concentration, and in the limit of high temperatures and high defect concentration c

$$k_g \propto [c(1-c)]^{-1/2} T^{-1/2} \qquad (29)$$

This is a result of the fact that in equation (21) point defect scattering leaves the mean free path of the lowest frequencies essentially unchanged.

Quantitative estimates of the strength of the point defect scattering can be made in terms of the difference in mass from that of a normal site and in terms of the volume misfit [3].

Equation (29) assumes absence of any correlation between the position of point defects. Short range order can lead to different frequency dependences and corresponding changes in the temperature dependence of k_g. An extreme case is presented by systematic spatial variations in the concentration, such as, for example, those due to the strain field of dislocations. These impurity atmospheres lead to scattering that simulates the scattering due to the dislocations which control the atmospheres [129].

4. OTHER CASES

With at least two types of carriers responsible for heat transport, and with each of them being limited by several possible mechanisms, thermal conductivity in metals and alloys [133–138] shows a wide range of differing behavior, which the present review cannot cover comprehensively. To add further to the variety, we have to consider other mechanisms of heat transfer and other mechanisms of resistivity, we also have to take into account cases of nondegeneracy of the electron gas, as are found in semimetals and semiconductors [139–158] of high carrier density, and finally we have to consider the thermal conductivity of superconductors [159–184].

Cooperative effects between the magnetic moments arranged in a regular lattice, leading to the concept of spin waves or magnons, can act both as a new mechanism of heat transport, and at the same time as a resistive mechanism of electronic and phonon transport [185–198].

In order for the localized magnetic moments arranged in a lattice to act as a carrier of heat, the magnetic dipoles of neighboring atoms must be coupled together, either by direct magnetic forces, or by indirect effects carried by the medium of the free electrons. Both the electronic magnetic moments and the nuclear magnetic moments can be involved in principle, though the latter would become important only at much lower temperature. The exchange energy is probably a rough criterion of the upper limit of temperature at which these effects need be considered. The rare earths, with their wide variety of magnetic effects, form a group of materials where magnetic effects are no doubt important, but their thermal conductivities are not well understood at present. Ferromagnetic and nearly ferromagnetic transition metals are another group where magnetic effects would be important. We are unable at present to give a comprehensive treatment of this field compactly.

The thermal conductivity of semimetals is understood in principle, but in practice we do not always have enough information to interpret it. There are two practical complications: (1) the electronic and lattice components are comparable and (2) the electronic component does not follow the Wiedemann–Franz–Lorenz law except at low temperatures.

The departure from the Wiedemann–Franz–Lorenz law follows from the lack of degeneracy at higher temperatures, i.e., the density of states, the electron velocity, and the electron mean free path vary as a function of electron energy, and the fractional variation over an energy interval of the order of κT above and below the Fermi energy ζ is not negligible, as it is in the case of the degenerate electron gas of good metals. Rules can be stated concerning the departure of the Lorenz number $k_e/\sigma T$ from L_0 in terms of the functional form of this variation [1]; the trouble is that in many cases we do not have enough information about the electronic band structure of the semimetals to benefit from these rules. Where we have this information, as in the case of graphite, we can make fairly good predictions about the Lorenz number; again in the limit of low temperatures we expect the Lorenz number to tend toward L_0.

Since in many cases we are not certain of the Lorenz number, we do not always know what fraction of the total thermal conductivity should be ascribed to k_e and to k_g.

The same considerations apply to semiconductors. In many cases k_g predominates and semiconductors should be classed as insulators for purposes of thermal conductivity. There are, however, a few cases where k_e is not negligible at higher temperatures. Since in the case of intrinsic semiconductors the Lorenz number can exceed L_0 by a substantial fraction, of order $(G/\kappa T)^2/12$, where G is the band gap energy, the Wiedemann–Franz–Lorenz law is not always a reliable guide in estimating the magnitude of k_e. When $G/\kappa T$ is large, σ and k_e are in any case small, but for intermediate values this enhancement of the Lorenz number, also known as ambipolar diffusion, can be significant [1].

It remains to consider the thermal conductivity of superconductors. Below the transition temperature T_c, a fraction of the conduction electrons rearrange themselves into an ordered state, of zero entropy, which can carry current without electrical resistance, and also exhibits special magnetic properties. This phenomenon of superconductivity can be quenched by a magnetic field; in many cases the required critical field is quite moderate. It is thus possible to measure the thermal conductivity below T_c, not only in the superconducting, but also in the normal state.

In the superconducting state, the electronic component k_e is reduced. The ratio k_{es}/k_{en} is a function of T/T_c; near T_c it also depends on the degree to which $W_{en} = 1/k_{en}$ is composed of intrinsic or defect-induced resistance. At sufficiently low temperatures, where the latter mechanism dominates, k_{es} decreases exponentially as a function of T_c/T.

While k_e is reduced, k_g is often increased in the superconducting state, because one mechanism of lattice thermal resistance, the scattering of phonons by electrons, is reduced. Well below the transition temperature, k_{gs} would be similar in character to k_g of a dielectric solid of corresponding mechanical properties, and be controlled by external boundaries, by lattice imperfections, and, in the case of polycrystalline aggregates, by the grain size.

In the case of pure superconductors, the total thermal conductivity k_s decreases below k_n, joining k_n at T_c; with decreasing temperature it first falls rapidly, reaches a minimum (when k_{gs} becomes appreciable), and then increases again. In that region it is very structure sensitive. Finally k_s reaches a maximum, and decreases again with decreasing temperature. At this lowest temperature k_s should depend on external or grain size, and may also be influenced by dislocations.

Many superconductors form an intimate mixture of normal and superconducting regions, either for geometric reasons or because (in superconductors of the second kind) such a mixed state is inherently more stable. The phase boundaries will then also act to limit the carrier mean free paths, and rather complex dependences on the history of the specimen may ensue. These phenomena are at present only partly understood.

Experimental Determination of Thermal Conductivity

1. INTRODUCTION

In the experimental determination of the thermal conductivity of solids, a number of different methods of measurement are required for different ranges of temperature and for various classes of materials having different ranges of thermal conductivity values. A particular method may thus be preferable over the others for a given material and temperature range, and no one method is suitable for all the required conditions of measurement. The appropriateness of a method is further determined by such considerations as the physical nature of the material, the geometry of samples available, the required accuracy of results, the speed of operation, and the time and funds entailed.

The various methods for the measurement of thermal conductivity fall into two categories: the steady-state and the nonsteady-state methods. In the steady-state methods of measurement, the test specimen is subjected to a temperature profile which is time invariant, and the thermal conductivity is determined directly by measuring the rate of heat flow per unit area and temperature gradient after equilibrium has been reached. In the nonsteady-state methods, the temperature distribution in the specimen varies with time, and measurement of the rate of temperature change, which normally determines the thermal diffusivity, replaces the measurement of the rate of heat flow. The thermal conductivity is then calculated from the thermal diffusivity with a further knowledge of the density and specific heat of the test material.

The primary concern in most methods of measurement is to obtain a controlled heat flow in a prescribed direction such that the actual boundary conditions in the experiment agree with those assumed in the theory. Theoretically, the simplest method to obtain a controlled heat flow is to use a specimen in the form of a hollow sphere with a heater in the center. The heat supplied by the internal heater passes through the specimen in a radial direction without loss. However, in reality it is very difficult to fabricate a spherical heater which produces uniform heat flux in all radial directions. It is also difficult to fabricate spherical specimens and to measure the heat input and the temperature gradient in this experimental arrangement.

A more commonly used method of controlling heat flow in the prescribed direction is the use of guard heaters (combined with thermal insulation in most cases) so adjusted that the temperature gradient is zero in all directions except in the direction of desired heat flow. In most methods of measuring thermal conductivity, a cylindrical specimen geometry ranging from long rod to short disk is utilized, and the heat flow is controlled to be in either the longitudinal (axial) or the radial direction. Thus, most methods can be subdivided into longitudinal and radial heat flow methods, as discussed in more detail later.

Experimental study of the thermal conductivity of solids was started in the eighteenth century. Benjamin Franklin [199] seems first to have pointed out, in 1753, the different ability of different materials "to receive and convey away the heat." He observed materials such as metal and wood to be good or poor conductors of heat by the degree of coldness felt when touched. Fordyce [200] pioneered in 1787 with experiments on the "conducting powers" of pasteboard and iron. The first steady-state *comparative* method for the measurement of the thermal conductivity of solids was suggested by Franklin and carried out by Ingen-Hausz as reported in 1789 [201]. This method was improved by Despretz as reported in 1822 [202], and Despretz's method was later used by Wiedemann and Franz as reported in 1853 [17] to determine the relative thermal conductivity of a number of metals, leading to the postulation of the Wiedemann-Franz law. Since the first steady-state *absolute* method was reported in 1851 by Forbes [203, 204] (see also [205, 206]) and the first nonsteady-state *absolute* method was reported in 1861 by Ångstrom [207], a number of different methods and their variants have been developed over the years. Several general surveys [208–218] are available for the experimental developments of the methods. The mathematical theories of the methods have been reviewed in several books [219–223].

In the sections that follow, the major methods and the extent of their applicability will be briefly described and discussed. For finer details of experimental designs and techniques, the reader is referred to the references given to the individual methods.

In the category of steady-state methods, we will discuss the longitudinal heat flow method, the Forbes' bar method (which is a quasi-longitudinal heat flow method), the radial heat flow method, the direct electrical heating method, the thermoelectrical method, and the thermal comparator method. In the longitudinal and radial heat flow methods, a distinction is made between absolute and comparative methods according to the means of measuring the heat flow. In an absolute method, the rate of heat flow into a specimen is directly determined, usually by measuring the electrical power input to a heater at one end of the specimen. The rate of heat flow out of a specimen may be measured with a flow calorimeter or boil-off calorimeter. With the latter the rate of heat flow is determined by the boil-off rate of liquid, such as water, of known heat of vaporization, while with the former it is determined by the flow rate and temperature rise of a circulating liquid, such as water, of known heat capacity. In a comparative method, the rate of heat flow is usually calculated from the temperature gradient over a reference sample of known thermal conductivity, which is placed in series with the specimen and in which, hopefully, the same heat flow occurs. The methods are further subdivided according to the various specimen geometries.

In the category of nonsteady-state methods, we will discuss the periodic and the transient heat flow methods. According to the direction of heat flow, each of them is also subdivided into longitudinal and radial heat flow methods. Within the transient heat flow methods, we will discuss also the flash method (which is a variant of the longitudinal heat flow method), the line heat source and probe methods (which are variants of the radial heat flow method), the moving heat source method, and two comparative methods.

It is worth noting that some of the methods discussed below are not suitable for good conductors. They may be suitable for poor conductors such as semiconductors and some for materials such as metallic powders and insulators.

2. STEADY-STATE METHODS

A. Longitudinal Heat Flow Methods

In the longitudinal heat flow methods, the experimental arrangement is so designed that the flow of heat is only in the axial direction of a rod (or disk) specimen. The radial heat loss or gain of the specimen is prevented or minimized and evaluated. Under steady-state conditions and assuming no radial heat loss or gain, the thermal conductivity is determined by the following expression from the one-dimensional Fourier–Biot heat-conduction equation [224, 225]:

$$k = \frac{-q\Delta x}{A\Delta T} \tag{30}$$

where k is the average thermal conductivity corresponding to the temperature $(\frac{1}{2})(T_1+T_2)$, $\Delta T = T_2 - T_1$, q is the rate of heat flow, A is the cross-sectional area of the specimen, and Δx is the distance between points of temperature measurements for T_1 and T_2. The different variants of this method are discussed separately below.

a. Absolute Methods

(i) *Rod Method.* This method is suitable for good conductors and for all temperatures except for very high temperatures. In fact, this method has been used for almost all measurements below room temperature. The specimen used is in the form of a relatively long rod so as to produce an appreciable temperature drop along the specimen for precise measurement. A source of heat at a constant temperature is supplied at one end of the rod and flows axially through the rod to the other end, where a heat sink at a lower constant temperature is located. The radial heat loss or gain of the rod should be negligible. In order to calculate the thermal conductivity from equation (30), it is necessary to measure the rate of heat flow into and/or out of the rod, the cross-sectional area, the temperatures of at least two points along the rod, and the distance between points of temperature measurements.

For measurements at cryogenic temperatures, radial heat loss does not constitute a serious problem, and thermal insulation and guard heaters are normally not necessary. The measurement is usually made under high vacuum to prevent gas conduction and convection, and a radiation shield surrounding the specimen may be used to minimize radiation losses. The heat issupplied to one end of thespecimen by a heating coil of fine resistance wire (which may be wound directly onto the specimen to eliminate contact resistance between heater and specimen) or by a carbon resistor attached to the end. The temperatures may be measured by gas thermometers, vapor-pressure thermometers, thermocouples, resistance thermometers, or magnetic-susceptibility thermometers. General reviewsofthelow-temperature measurements and experimental techniques have been presented by White [226, 227]. For details of some of the useful low-temperature apparatus the reader may consult references [228–239].

For measurements at high temperatures, heat loss becomes a serious problem because radiant heat transfer increases rapidly with temperature. To prevent radial heat losses, a guard tube surrounding the specimen with controlled guard heaters may be utilized. Insulating powder is usually used to fill the space between the rod specimen and the guard tube, which should have the same temperature distribution along it as does the rod specimen. In fact, as early as 1887, Berget [240, 241] started the use of a guard ring surrounding (and with the same temperature distribution as) the specimen to prevent heat losses.

The rate of heat flow into the specimen may be determined by measuring the power input to a guarded electrical heater at the free end of the rod specimen [242–244], or by measuring the heat flow out of the specimen with a water-flow calorimeter at the low temperature end [245], or by both [246–248]. Temperature measurements are made usually with thermocouples. In order to get correct temperature measurements and to minimize heat conduction along thermocouple leads, the thermocouples should be made of fine wires of low-conductivity alloys, and the leads from the junction should be along isothermal lines.

This method, as used for measurements at high temperatures, has been comprehensively reviewed and discussed by Laubitz [249] and Flynn [250]. Systematic errors in measurements caused by the effects of heat losses, thermal contact resistance, poor thermocouple contacts, and temperature drift have been analyzed by Bauerle [251].

A variation of this method has been used [252–254] in which the specimen heater is located in a cavity at the center of the rod specimen and a heat sink is at each end. A mean value of the temperature gradient established towards the two ends is used for the thermal conductivity calculation.

(ii) *Plate (or Disk) Method.* This method is suitable for poor conductors such as semiconductors and for low-conductivity materials such as compacted metallic powders and insulators. It is similar to the rod method except for the specimen length to width ratio being greatly reduced to a small fraction. This specimen geometry is favorable for measuring poor conductors, because, the smaller the length to width ratio, the smaller is the ratio of lateral heat losses to the heat flow through the specimen, and the shorter is the equilibrium time. The size of specimen used in various apparatus designed for different kinds of materials varies greatly. For apparatus designed to measure semiconductors, the specimen used may be about 1-cm wide [255], while the apparatus for measuring less homogeneous insulating or refractory materials may require a specimen of over 1 foot in width [256].

In this method, the thermal conductivity is also given by equation (30). The rate of heat flow may be determined by the electrical power input to a guarded heater [256–258], by a guarded water-flow calorimeter [259], by a boil-off calorimeter [260–263], or by a heat flow meter [264]. Temperature measurements are made generally with thermocouples inserted in the specimen or embedded in grooves on the specimen surfaces, depending on the materials tested. Lateral heat losses may be prevented either by utilizing guard heaters or by using a large specimen, of which only a relatively small central area is used for measurement. In the first detailed mathematical analysis of the plate method reported in 1898, Peirce and Willson [265] found already that if the radius of the specimen is five times larger than that of the central test section whose thickness equals its radius, the temperature at any point within the central test section would not sensibly differ from the temperature at the corresponding point in an infinite disk of the same thickness and same face temperatures. Further mathematical analyses of the errors due to lateral heat loss in guarded hot plate apparatus have been given in [266–268].

Detailed descriptions of recent apparatus for measurements at cryogenic temperatures can be found in the articles collected in [269], and for measurements at high temperatures in [270]. A comprehensive review of the plate method has been given in [271]. A description of the NBS steam calorimeter apparatus and some useful discussions on this method have also been given in [250].

There are two main kinds of experimental arrangements for the absolute plate (or disk) method: the single-plate system and the twin-plate system. The single-plate system [255, 258–265] requires only one specimen, which is placed between a hot plate and a cold plate, while the twin-plate system [256, 257] requires two similar specimens to be sandwiched between a hot plate in the middle and two cold plates on the outside. The plate method employing the single-plate system was probably first used by Clément, whose experiment on copper was cited by Péclet [272] in 1841. Péclet also used this method to measure the thermal conductivity of copper, and both of them obtained erroneous results. Later improvements on this method have been made by Peirce and Willson [265] and Lees [273] among others. The idea of a twin-plate system was developed by Lees [273] in 1898, but he did not actually adopt the twin-plate system for his plate method in the series of measurements as reported in [273]. However, he used the twin-plate system in his experiments on the effect of pressure on thermal conductivity reported in 1899 [274]. Great improvement on the plate method employing the twin-plate system was made by Poensgen [257] in 1912, who introduced the guard-ring heater to the system as the prototype of the modern guarded hot-plate apparatus.

b. Comparative Methods

In the earliest steady-state comparative method suggested by Franklin and carried out by Ingen-Hausz [201] as reported in 1789, rods of various metals were coated with wax and heated at one end to a common temperature in a bath of hot water or oil. The wax melted over a greater distance on a rod of better conducting material, and under steady-state conditions the ratio of the conductivities of the rods is roughly proportional to the squares of these distances. The modern comparative methods are divided-rod (or cut-bar) method and the comparative plate method as discussed below.

(i) *Divided-Rod (or Cut-Bar) method.* The divided-rod method was originated by Lodge [275] in 1878 and later used by Berget [276], Lees [277], and many others. In this method a reference sample (or samples) of known thermal conductivity is placed in series with the unknown specimen with hopefully the same rate of heat flow through both the reference sample and the specimen. Under such ideal conditions, the thermal conductivity of the specimen is given by

$$k = k_r \frac{A_r(\Delta T/\Delta x)_r}{A(\Delta T/\Delta x)} \tag{31}$$

where the subscript r designates the reference sample.

This method may be divided into two distinct groups: the "long-specimen" type [276, 278, 279] for measuring the thermal conductivity of good conductors, and the "short specimen" type [275, 277, 280–283] for measuring poor conductors.

Comparative methods have the advantages of simpler apparatus, easier specimen fabrication, and easier operation. Their disadvantages include additional measurement errors due to the required additional measurements of temperatures and thermocouple separations, difficulty in matched guarding, and lower accuracy due to the additional uncertainty in the conductivity of the reference sample, due to the conductivity mismatch between specimen and reference sample, and due to the interfacial thermal contact resistance. These have been carefully analyzed by Laubitz [249] and Flynn [250]. Flynn [250] has pointed out that the ASTM standard cut-bar method C408–58 [282] is not well designed, and the data obtained by using this method can be subject to large errors.

(ii) *Plate (or Disk) Method.* This comparative method is suitable for poor conductors and insulators and is similar to the divided-rod method in principle except that the specimen and the reference samples are now flat plates (or disks) sandwiched between a hot and a cold plate. Christiansen [284] was the first to report in 1881 the use of this type of comparative method in which he compared the thermal conductivity of liquids with that of air. Peirce and Willson [265] used this method to measure the thermal conductivity of marble slabs with glass plates as reference material for comparison. Sieg [285] employed the guard ring in his apparatus to prevent lateral heat loss.

c. Combined Method

In using a "combined" method, the apparatus combines the features of both absolute and comparative methods. The rate of heat flow is determined both through a reference sample placed in series with the specimen and simultaneously by a water-flow calorimeter [286–288] or by measuring the electrical power input to a heater [289]. In the measurements reported in [289], a "dual combined" method was employed in which a heater is located at the center of the divided rod between two short specimens with two longer reference samples at the two ends which are cooled by flowing water.

B. Forbes' Bar Method

Forbes' original method [203–206] consists of two separate experiments. The first was termed by Forbes the *statical*, and the second the *dynamical*, or cooling experiment. In the *statical* experiment a square wrought iron bar with 1.25-inch side and 8 feet long was heated at one end by molten lead or solder at a fixed high temperature, and the steady-state temperature distribution along the bar was determined with the surface of the bar losing heat by convection and radiation to a constant-temperature environment. In the *dynamical* or cooling experiment, a similar bar but only about 20 inches long was cooled in the same environment from a high uniform temperature, and the rate of heat loss was determined. From these two experiments, the thermal conductivity may be computed as follows.

Replacing $\Delta x/\Delta T$ in equation (30) by dx/dT, differentiating the resulting equation with respect to x, and rearranging gives

$$k = \frac{1}{A}\frac{dq}{dx}\frac{1}{d^2T/dx^2} \tag{32}$$

The statical experiment provides values for d^2T/dx^2, and the heat loss per unit time per unit length of the bar in the cooling experiment is

$$\frac{dq}{dx} = AC\frac{dT}{dt} \tag{33}$$

where dT/dt is the measured cooling rate and C the specific heat per unit volume.

Hogan and Sawyer [290] have improved this method so that it is not necessary to know the specific heat of the material. They used a thin long rod enclosed in an isothermal furnace. Radial heat loss from the specimen was determined by passing an electric current through the specimen and measuring the electric power required to maintain it at a temperature slightly above that of the furnace. This replaces Forbes' cooling experiment, and it is not necessary to know the specific heat since a steady-state condition is prevailing.

Hogan and Sawyer's method was further improved by Laubitz [291]. In his comprehensive review Laubitz [249] has discussed in detail the generalized Forbes' bar method, including the other major variants currently in use [292–294].

C. Radial Heat Flow Methods

There are several different types of apparatus all employing radial heat flow. The classification is mainly based upon specimen geometry. In the following we will briefly describe the cylindrical, spherical, ellipsoidal, concentric sphere, concentric cylinder, and plate methods. The reader is referred to the references given for the individual methods for finer details. A comprehensive review of radial heat flow methods has been made by McElroy and Moore [295].

a. Absolute Methods

(i) *Cylindrical Method.* The cylindrical method uses a specimen in the form of a right circular cylinder with a coaxial central hole, which contains either a heater or a heat sink, depending on whether the desired heat flow direction is to be radially outward or inward. The use of this method was first reported by Callendar and Nicolson [296] in 1897 for measuring the thermal conductivity of cast iron and mild steel. The cylindrical specimens used were 5 inches in diameter and 2 feet long with 1-inch coaxial holes heated by steam under pressure. The outside of the cylinder was cooled by water circulating rapidly in a spiral tube. Niven [297] in 1905 also used the radial heat flow method for measurements on wood, sand, and sawdust. His method is close to the so-called hot-wire method developed by Andrews [298] in 1840 and Schleiermacher [299] in 1888 for measurements on gases. Kannuluik and Martin [300] used the hot-wire method for measurements on powders as well as on gases.

In the early experiments and also in many later designs [301–304], end guards are not employed. The effect of heat losses from the ends of the specimen is minimized by using a long specimen and monitoring the electric power within only a small section of the specimen away from the ends.

The guarded cylindrical method employing end guards at both ends of the specimen to prevent axial heat losses was developed by Powell [305] and first reported in 1939 for measurements on Armco iron at high temperatures. In the guarded cylindrical method the specimen is generally composed of stacked disks with a coaxial central hole containing either a heater or a heat sink. Temperatures within the specimen are measured either by thermocouples or by an optical pyrometer. For details of some of the useful apparatus employing the guarded cylindrical method, the reader may consult references [295, 305–310].

The thermal conductivity is calculated from the expression

$$k = \frac{q \ln(r_2/r_1)}{2\pi l(T_1 - T_2)} \tag{34}$$

where l is the length of the central heater and T_1 and T_2 are temperatures measured at radii r_1 and r_2, respectively.

Hoch *et al.* [311] have developed a quasi-radial heat flow method in which the specimen in the form of a disk or short cylinder is heated at its convex cylindrical surface in high vacuum by means of high frequency induction and is losing heat from its flat circular end faces by radiation. In this method the inward flow of heat from the cylindrical surface, at which the generation of heat is localized, into the interior of the specimen is, of course, not strictly radial, and the temperature gradient of the flat circular end faces along the radius is related to the thermal conductivity. The theory of this method has recently been revised by J. Vardi and R. Lemlich (to be published in the *Journal of Applied Physics* in 1970).

(ii) *Spherical and Ellipsoidal Methods.* In a spherical method, the heater is completely enclosed inside the specimen which is in the form of a hollow sphere. The heat supplied by the internal heater passes through the specimen radially without loss. Theoretically, this method is ideal. However, there are a number of practical difficulties such as difficult fabrication of a spherical heater which produces uniform heat flux in all radial directions, difficult fabrication of spherical specimens, difficult positioning of thermocouples along spherical isotherms, etc., which have prevented this method from being popular. Laws, Bishop, and McJunkin [312] seem the first to have used this method on solids (not loose-filled materials). A detailed description of a modern design may be found in [301]. The thermal conductivity is calculated from the expression

$$k = \frac{q(1/r_1 - 1/r_2)}{4\pi(T_1 - T_2)} \tag{35}$$

The ellipsoidal method is similar to, but has some advantages over, the spherical method. It was developed by a group of researchers at MIT [313–315]. The major advantage of using a specimen in the form of an ellipsoid instead of a sphere is that the isothermal surfaces near the plane of the minor axes of an ellipsoid are rather flat so that straight thermocouple wires can be used without ill effect. If a is half the focal length of the ellipsoid and T_1 and T_2 are temperatures measured at respectively two radii r_1 and r_2 on the minor axis, the thermal conductivity is determined by the expression

$$k = \frac{q}{8\pi a(T_1 - T_2)} \times \ln\left(\frac{\sqrt{(a^2 + r_2^2)} - a}{\sqrt{(a^2 + r_2^2)} + a} \cdot \frac{\sqrt{(a^2 + r_1^2)} + a}{\sqrt{(a^2 + r_1^2)} - a}\right) \tag{36}$$

Despite the aforementioned advantage, the ellipsoidal method is also rarely used due to the other experimental difficulties common to both the ellipsoidal and spherical methods.

(iii) *Concentric Sphere and Concentric Cylinder Methods.* Concentric sphere and concentric cylinder methods are used mainly for measurements on powders, fibers, and other loose-filled materials. The specimen is filled in the space between two concentric spherical (or cylindrical) shells, with the inner sphere (or cylinder) being a heater or a heat sink. In a concentric cylinder apparatus, end guards are usually used to prevent axial heat flow.

A concentric sphere method was first used by Péclet [316] and reported in 1860 with the inner sphere filled with hot water as heater. However, a steady-state condition was not achieved in his pioneering measurements. Later Nusselt [317] succeeded in using this method for measurements on insulating materials with an electric heater installed inside the inner spherical shell. A modern apparatus using a boil-off calorimeter in the inner sphere was described in [318].

A concentric cylinder method was used by Stefan [319] and reported in 1872 for the measurements on gases. It was later adopted for measuring loose-filled materials. Reference [320] describes a modern apparatus employing a guarded boil-off calorimeter inside the inner cylinder. Recently, Flynn and Watson [321] used a concentric cylinder method to measure the high-temperature thermal conductivity of soil.

(iv) *de Sénarmont's Plate Method.* de Sénarmont [322–326] in 1847–48 used a radial heat flow plate method to determine the anisotropy in thermal conductivity of crystalline substances. However, this method does not yield absolute values of thermal conductivity, and furthermore, the axial heat loss is not prevented.

In his method, a thin plate of the sample was coated with a thin film of white wax; heat was applied at a central point by means of a hot, thin silver tube tightly fitted in a hole at the center of the plate. The wax melted around the region where heat was supplied and the bounding line of the melted wax was the visible isotherm, the shape of which indicated the variation of thermal conductivity in the different directions.

If the substance is isotropic, the bounding curve of the melted wax is a circle, whereas for anisotropic substances, this curve is elliptical. In such a case, the ratio of the two thermal conductivities k_a and k_b along the two axes a and b of the ellipse is given by the expression

$$\frac{k_a}{k_b} = \left(\frac{a}{b}\right)^2 \tag{37}$$

Powell [327] has modified the method in his simple test for anisotropic materials. In testing gallium, he cooled a slice of crystal locally by means of a piece of solid carbon dioxide and observed the contours of the dew and frost areas which formed around the cooled zone. For testing graphite, he followed de Sénarmont's original method but the surface of the plate used was covered with frost by precooling instead of being coated with wax.

b. Comparative Methods

(i) *Concentric Cylinder Method.* This method has been used for measurements on some special materials such as those that are radioactive or reactive [328–330] and not for ordinary materials, because it does not have any major advantage over the absolute method. A typical apparatus of this kind consists of a cylindrical specimen which is surrounded by a concentric cylindrical reference sample of known thermal conductivity. A coaxial central hole in the specimen contains a heat source, which produces heat flowing radially through both the specimen and the reference sample. The advantage of using this method for measuring radioactive or reactive materials is that the reference sample which encloses the specimen serves also as a means of containment. The thermal conductivity is determined from the expression

$$k = k_r \frac{(T_3 - T_4)\ln(r_2/r_1)}{(T_1 - T_2)\ln(r_4/r_3)} \tag{38}$$

where T_1 and T_2 are two temperatures measured in the specimen at two radii r_1 and r_2, respectively, and T_3 and T_4 in the reference sample, at r_3 and r_4, respectively.

(ii) *Disk Method.* Robinson [331] developed a method, which he termed the "conductive-disk method," for comparative measurements on insulators. This method employs inward radial heat flow from a heater at the circular edge of a disk of suitable conductive reference material sandwiched between two like specimens, which are in turn sandwiched between two circular cold plates at a constant lower temperature. However, the heat flow in this case is not strictly radial, since, as the heat flows radially in the conductive disk toward the center, it flows also from the disk through the specimens to the cold plates. As a result, the steady-state temperature of the disk decreases toward its center, and the rate of decrease depends on the thermal conductivity of the specimens. Robinson obtained an expression for calculating the thermal conductivity of the specimens from the known thermal conductivity and thickness of the disk and from the temperatures of the cold plates and of the disk at its center and at a suitable radius.

D. Direct Electrical Heating Methods

In direct electrical heating methods, the specimen is heated directly by passing an electric current through it. These methods are therefore limited to measurements on reasonably good electrical conductors. Furthermore, they usually yield thermal conductivity in terms of electrical conductivity rather than directly. However, direct electrical heating methods have also certain advantages over other methods. They offer a means of easily attaining very high temperatures, use simpler apparatus and experimental techniques than other methods at high temperatures, use relatively small specimens, require relatively short time to reach equilibrium, and also offer the possibility of concurrent determinations of a number of physical properties on the same specimen. According to specimen geometry, these methods fall into two major categories: cylindrical rod and rectangular bar. They will be briefly discussed below. Comprehensive reviews [332–334] on direct electrical heating methods are available.

The thermoelectrical method to be discussed later involves also the direct passage of an electric current through the specimen. However, in that method the specimen is heated (and cooled) by the Peltier effect which is totally different from the Joulean heating responsible for maintaining the specimen temperature in the direct electrical heating methods discussed here. It is therefore preferable to discuss the thermoelectrical method separately in another section.

a. Cylindrical Rod Methods

The direct electrical heating methods in this category involve heating specimens in the form of rods, thin wires, or tubes by the passage of regulated electric current, and measuring potential drops and temperatures for the calculation of thermal conductivity.

There are many different techniques and variants that have been employed over the years since Kohlrausch [335–338] first developed this method. The different variants may be divided into three categories as discussed below.

(i) *Longitudinal Heat Flow Method.* In this method the rod is well insulated or guarded to prevent radial heat losses so that the Joule heat generated in the specimen flows to the two ends. This is the method originally developed by Kohlrausch [335–338]. If the two ends of the rod are held at the same temperature and assuming that in a small temperature range the thermal and electrical conductivities are independent of temperature, the thermal conductivity is given by the simple relation

$$k = \frac{1}{8\rho}\frac{(V_1 - V_3)^2}{(T_2 - T_1)} \tag{39}$$

where ρ is the electrical resistivity, V_1 and V_3 are the electrical potentials at locations 1 and 3 on the specimen which are at equal and opposite distances from the midpoint 2, and T_1 and T_2 are temperatures at locations 1 and 2. This method was first used for actual measurements by Jaeger and Diesselhorst [339]. A variant of it has been used by Mikryukov [332]. The so-called "necked-down-sample method" [340] may also be considered as a longitudinal heat flow method.

(ii) *Radial Heat Flow Method.* This method uses a thick rod or tube and allows radial heat transfer. Under steady-state conditions, the Joule heat generated in the specimen at regions remote from the ends flows radially to the surface and is then transferred by convection and radiation to the surroundings. This method was first suggested by Mendenhall and applied by Angell [341]. In the case of a cylindrical rod specimen and assuming that in a small temperature range the thermal and electrical conductivities are independent of temperature, the thermal conductivity is given by the simple relation

$$k = \frac{EI}{4\pi l(T_1 - T_2)} \tag{40}$$

where I is the electric current, E is the electrical potential drop over a length l at the central region of the specimen, and T_1 and T_2 are the temperatures at the axis and surface, respectively, of the rod at the central region. These temperatures were too small for precise measurements on metals, but Powell and Schofield [342] used it for poorer conducting carbon and graphite, and they also took account of the variation of thermal and electrical conductivities with temperature.

(iii) *Thin-Rod-Approximation Method.* The general form of the present method uses a long thin filament heated electrically in vacuum and allows both longitudinal heat conduction and lateral heat transfer by radiation. The "thin-rod approximation" involves the assumption that the temperatures and potentials in all planes normal to the specimen axis are uniform, i.e., their differences in the radial direction are negligible. Worthing [343] first employed this method for measurements on U-shaped filaments at incandescent temperatures. There are many variants [344–358] of this method, all with more or less different experimental designs, mathematical assumptions, and/or computational techniques.

Taylor, Powell, and co-workers [354, 356–358] at TPRC have made improvements and advancements on this method. They have taken the Thomson effect into account, which had never been done before, and have included the temperature dependence of various physical properties. They used the general equation directly and their advanced computational techniques have eliminated the need for mathematical approximations and for matching certain experimental conditions.

It seems appropriate to mention the considerable discrepancies which have resulted from the data obtained by various workers, all of whom used different variants of the direct electrical heating method. One of the most recent of the TPRC papers [358] contains an interesting graphical presentation of all the determinations made on tungsten by these methods for the temperature range 1600 to 2800 K. Six of the fourteen groups of workers obtained results lying well above the recommended curve of Powell, Ho, and Liley [359], and one was well below it, the spread being of the order of 50 percent, 80 percent, and 70 percent at 1800, 2200 and 2600 K, respectively. The other seven had results within about 10 percent of the recommended curve, while the curve fitting the new results of [358] was some 3 to 5 percent below the recommended curve. Earlier reports [333, 356] had contained examples of similar discrepancies for other high-melting-point metals, such as molybdenum, stainless steel, and platinum. The main reasons for these differences include failure to measure accurately small temperature gradients at high temperature, failure to match boundary conditions, errors resulting from simplifying mathematical approximations, and the use of temperature regions in which the thermal conduction term is small compared with the Joulean heating and radiation loss terms.

These have been quoted as examples of current experimental work at the TPRC, which became necessary because of the need to resolve some seriously discordant data and to gain further insight into their causes. The impression must not be given, however, that such discrepancies are confined to metals or to direct electrical heating methods. This is by no means the case, and the literature of heat conduction contains many examples of discordant results for all types of methods used. Titanium carbide, one of the materials dealt with in Volume 2, may be mentioned. The first determinations reported on titanium carbide by Vasilos and Kingery [360] to high temperatures showed the thermal conductivity to decrease from about 0.2 W cm^{-1} C^{-1} at 200 C to 0.1 W cm^{-1} C^{-1} at 500 C and 0.04 W cm^{-1} C^{-1} at 1000 C. Two methods had been used: the divided-rod comparative method for a cube sample up to about 800 C and an ellipsoidal radial-flow method from about 500 to 1100 C. The former method gave results which were greater by from 30 percent to 20 percent over their common temperature range. In 1961 Taylor [361] used a better-substantiated radial heat flow method for cylindrical samples of titanium carbide, and found the thermal conductivity to increase linearly from 0.38 W cm^{-1} C^{-1} at 600 C to 0.47 W cm^{-1} C^{-1} at 1600 C.

These two sets of values, differing at about 1000 C by about one order of magnitude and having temperature coefficients of opposite sign, naturally aroused interest, and subsequent contributions by Laubitz [362], Hoch and Vardi [363], and Powell [364, 365] and the nonsteady-state measurements of Taylor and Morreale [366] all supported the higher values of Taylor [361]. It would seem that the higher thermal conductivity of titanium carbide led to serious errors being associated with the method of Vasilos and Kingery, which were not apparent for substances of lower thermal conductivity. Incidently, had the much simpler measurement of electrical resistivity been also made, the unusually low resultant Lorenz function should have provided warning that abnormal data were being obtained. It might well be added that the inclusion of electrical resistivity measurements on all possible occasions is a simple extra measurement which also serves to provide very useful information about the properties of the material under test and its behavior on temperature cycling.

The foregoing example also indicates that users of the data tables of these volumes should, in the absence of any analysis that has produced a curve of recommended values, tend to be critical of the values presented, until these are seen to be well supported by independent experiments, correlations, or by additional checks such as that of a reasonable Lorenz function.

An additional outcome of the current TPRC investigation has been the development of a method and of equipment capable of determining a large number of high-temperature physical properties [367]. Their multiple-purpose apparatus is the first operational model that can accurately measure the thermal conductivity, electrical resistivity, total and spectral hemispherical emittance, Thomson coefficient, and Lorenz function on one and the same specimen. This apparatus can also measure the specific heat, enthalpy, thermal diffusivity, thermal expansion, Seebeck coefficient, Peltier coefficient, and Richardson coefficient. The merit of obtaining many different physical properties from one and the same specimen so as to permit meaningful quantitative cross-correlations between properties need not be emphasized here.

b. Rectangular Bar Method

This method was developed by Longmire [368] and is a geometrically-deformed variant of the radial heat flow method. The specimen used is in the form of a long rectangular bar. This special specimen geometry enables all temperature measurements to be made on the surface of the specimen. As the specimen is heated electrically in vacuum, the heat loss by radiation establishes a radial temperature gradient, and the temperature at the center line of the wider surface of the rectangular bar will be higher than that at the center line of the narrower surface. From measurements of these two temperatures and the electrical conductivity and total hemispherical emittance of the bar, the thermal conductivity can be calculated using the equation derived by Longmire.

Longmire's method was improved by Pike and Doar [369–371] both in mathematical analysis and in experimental techniques. They further extended this method to the determination of anisotropy in thermal conductivity.

E. Thermoelectrical Method

The thermoelectrical method was developed by Borelius [372] and reported in 1917 for the combined measurement of the Peltier heat and thermal conductivity of the same material, and is particularly applicable to the measurements on thermoelectric materials.

In this method, the specimen is held between metallic contacts through which a small direct electric current is passed. Peltier heating thus occurs at one end of the specimen and Peltier cooling at the other end, which establishes a temperature gradient along the specimen. Under steady-state conditions, the rate of Peltier heat generation at the hot end is just balanced by the rate of heat conduction from the hot to the cold end. Thus the thermal conductivity can be calculated from the rate of Peltier heat production πI (π being the Peltier coefficient), the temperature difference between the ends ΔT, the cross-sectional area A, and the length l by the expression

$$k = \frac{\pi I l}{A \Delta T} \tag{41}$$

Since $\pi = ST$, S being the Seebeck coefficient, π can be determined by measuring the Seebeck coefficient from the potential difference between the ends after the temperature difference ΔT is established.

When the direct electric current is passed through the specimen, Joulean heating will occur, of course. However, the Joulean heating effect can be made negligibly small in a good thermoelectric material by choosing the current small enough, because the Joule heat production is proportional to I^2 while the Peltier heat production is proportional to I. The Thomson heat effect is generally small.

Borelius' method was used by Sedström [373, 374] for measurements on alloys. Some forty years later, Putley [375] and Harman [376, 377] reinvented this method. A recent apparatus is described in [378].

A transient thermoelectrical method was developed by Hérinckx and Monfils [379]. In this method a direct electric current is passed through the specimen and the time dependence of the resulting potential drop across the specimen is observed. The thermal conductivity can be derived from the shape and asymptote of this potential drop versus time curve provided that the Seebeck coefficient is known.

F. Thermal Comparator Method

The thermal comparator method was developed by Powell [380–383] and is a simple comparative method for the rapid, easy measurement of thermal conductivity.

The essential part of the thermal comparator is an insulated probe with a projecting tip. The probe is integral with a thermal reservoir held at a temperature about 15 to 20 degrees above room temperature. A surface thermocouple is mounted at the tip of the probe and is differentially connected to the thermal reservoir for the measurement of the temperature difference between the reservoir and the tip.

In operation, the probe is gently placed on the surface of the test material. Upon contact of the probe tip of known thermal conductivity k_1 and originally at temperature T_1 with the surface of the test material of thermal conductivity k_2 and at room temperature T_2, the temperature of the probe tip drops quickly to an intermediate temperature, T, given by the expression

$$T_1 - T = (T_1 - T_2)\left(\frac{k_2}{k_1 + k_2}\right) \tag{42}$$

This temperature difference is registered by the emf reading of the differential thermocouple after a brief transient period (1 to 2 seconds) has elapsed.

From the emf readings of tests on a series of reference samples of known thermal conductivity, a calibration curve is obtained, and the thermal conductivity of an unknown specimen can thus be determined from the emf reading through the calibration curve.

Powell [384] has made a comprehensive review on this method. Some subsequent developments are discussed in [385]. The *thermal comparator* has been developed by TPRC as an instrument [385] for the rapid determination of the thermal conductivity of solids and liquids and is commercially available from The McClure Park Corp., West Lafayette, Indiana.

3. NONSTEADY-STATE METHODS

In nonsteady-state methods, the temperature distribution in the specimen varies with time. The rate of temperature change at certain positions along the specimen is measured in the experiment, and no measurement of the rate of heat flow is required. These methods normally determine the thermal diffusivity, from which the thermal conductivity can be calculated with an additional knowledge of the density and specific heat of the test material. Nonsteady-state methods fall into two major categories, the periodic and the transient heat flow methods, as briefly discussed below. These methods have been comprehensively reviewed by Danielson and Sidles [386], and will be dealt with in Volume 10 of the TPRC Data Series.

A. Periodic Heat Flow Methods

In periodic heat flow methods, the heat supplied to the specimen is modulated to have a fixed period. The resulting temperature wave which propagates through the specimen with the same period is attenuated as it moves along. Consequently, the thermal diffusivity can be determined from measurements of the amplitude decrement and/or phase difference of the temperature waves between certain positions in the specimen. In most of the periodic heat flow methods, heat flow is in the longitudinal (axial) direction. However, methods with heat flow in the radial direction have also been used.

a. Longitudinal Heat Flow Method

The periodic heat flow method was first developed by Ångström [207, 387] and reported in 1861. In his method a variable heat source capable of producing a sinusoidal temperature variation was attached to the center of a long thin rod specimen, and the temperatures as a function of time at two positions l apart towards the ends of the rod were measured. From these temperature-time measurements, the velocity, v, and the amplitude decrement δ of the temperature wave can be determined for the calculation of thermal diffusivity. This method has been modified and improved by King [388] and others [389–391]. The thermal diffusivity may be calculated from the expression [390]

$$D = \frac{vl}{2 \ln \delta} \tag{43}$$

The Ångström method, which uses a long rod, has its limitations. In some cases, specimens in the form of long rods may not be available, and in other cases, such as in the measurements on poor conductors at high temperatures, heat guarding to prevent lateral heat losses from a long rod may be difficult. Consequently, methods using specimens in the form of a small plate or disk have been developed [392–394].

b. Radial Heat Flow Method

In this method, the specimen in the form of a cylinder is heated by a heat source capable of producing a periodical temperature variation either at the axis or at the circumference, and the radial temperature variations with time are measured. The thermal diffusivity may be calculated from the phase change of the temperature oscillations, or from the amplitude variation of the oscillations with frequency.

Tanasawa [395] used this method in 1935 for the measurements on humid materials. In his method, a sinusoidal temperature was produced on the surface of a cylindrical specimen, and the temperatures at different radial distances were measured for the calculation of thermal diffusivity.

Filippov and his co-workers have further developed a method of this type [396] and used it for the measurements on metals [397] and molten metals [398, 399] at high temperatures.

The nonsteady-state radial heat flow method has also been employed for measurements on insulators [400, 401].

B. Transient Heat Flow Methods

Transient heat flow methods, both longitudinal and radial, were first used by Neumann [402, 403] and reported in 1862. In his method, one end of a bar was heated by a flame until the temperature attained the equilibrium state. The flame was then suddenly removed and temperatures at two positions along the bar were measured as a function of time. Thermal diffusivity can then be calculated from these measurements. For the measurements on poor conductors, he used another method in which a cube or sphere was heated uniformly to a high temperature and then was allowed to cool in the air. The temperatures at the surface and at the center were measured as a function of time.

The modern transient heat flow methods have a wide variety. In the following a number of the major variants are briefly discussed.

a. Longitudinal Heat Flow Method

Similar to the longitudinal periodic heat flow method, the longitudinal transient heat flow method can also be subdivided into two major categories, those using a long rod and those using a small plate (or disk).

Methods in which one end of a long rod, which is initially at uniform temperature, is subjected to a short heating pulse have been developed [404, 405]. There are also methods in which steady heating is provided at one end of a rod and the temperatures as a function of time at two or more positions along the rod are observed [406–408].

Transient heat flow methods in which the specimen used is in the form of a small plate or disk have been developed by a number of workers [409–412].

b. Flash Method

Although the flash method is a variant of the longitudinal transient heat flow method using a small thin disk specimen geometry, it has a very special feature which makes it a class of its own. In the "flash" method, a flash of thermal energy is supplied to one of the surfaces of a disk specimen within a time interval that is short compared with the time required for the resulting transient flow of heat to propagate through the specimen. This method was developed by Parker, Jenkins, Butler, and Abbott [413] and reported in 1961.

In use, a heat source such as flash tube or laser supplies a flash of energy to the front face of a thin disk specimen, and the temperature as a function of time at the rear face is automatically recorded. The thermal diffusivity is given from the thickness of the specimen, l, and a specific time, $t_{1/2}$, at which the back-face temperature reaches half its maximum value by the expression

$$D = 1.37\, l^2/\pi^2 t_{1/2} \tag{44}$$

Other expressions for the calculation of thermal diffusivity have also been used.

Subsequent improvements on this method have been made [414, 415] by the application of corrections for the finite pulse-time effect and the radiation-loss effect.

c. Radial Heat Flow Method

As mentioned before, a radial heat flow method was used by Neumann [402, 403] for measurements on poor conductors. His specimens were of spherical shape.

In modern apparatus, specimens in the form of cylinders are used. A long cylindrical specimen, hollow or solid, which is initially at uniform temperature, is heated either at the axis or at the outer surface and the temperatures as a function of time at different radial distances are measured. In the methods developed by Ginnings [416] and by Cape, Lehman, and Nakata [417], cylindrical specimens were continuously heated at the outer surface.

Specimens in the form of hollow disks stacked on an axial heater with outer disks as end guards have been used by Carter, Maycock, Klein, and Danielson [418].

Although the line heat source and probe methods are also radial transient heat flow methods, they are quite different from other methods and will be discussed in a separate section below.

d. Line Heat Source and Probe Methods

The line heat source method was originally developed by Stalhane and Pyk [419] in 1931 and used for measurements on ceramic materials [420]. This method is suitable for the measurements on loose-filled materials such as powders.

In this method, a long thin heater wire which serves as a line heat source was embedded in a large specimen initially at uniform temperature. The heater is then turned on, which produces constant heat, q, per unit length and time, and the temperature at a point in the specimen is recorded as a function of time. The thermal conductivity is given by the expression

$$k = \frac{q}{4\pi(T_2 - T_1)} \ln \frac{t_2}{t_1} \tag{45}$$

where $(T_2 - T_1)$ is the temperature difference at two times t_1 and t_2. Subsequently, this method was also developed by van der Held and his co-workers [421, 422], and others.

The probe method is a more practical line heat source method in which the heat source is enclosed inside a probe for protection and for easy insertion into a specimen. This method was developed by Hooper and his co-workers [423, 424], and others. Blackwell [425, 426] has derived theoretical treatments for practical departures from a true line source, and in the discussion of a paper [427] dealing with the use of a probe method in connection with the routing of electric power cables, he advocated the use of very small thermistors as an alternative to thermocouples.

e. Moving Heat Source Method

The moving heat source method was developed by Rosenthal and his co-workers [428–430], and involves the establishment of a quasi-steady-state temperature distribution in a long tubular-shaped specimen heated by a moving localized heat source of constant intensity. As the heat source approaches and moves away, each point in the specimen is subjected to a temperature rise and fall. When the heat source passes over the specimen, the temperature at a point remote from the ends is recorded as a function of time. From this record, a curve of the logarithm of the temperature variation with time is made. The thermal diffusivity is given from the velocity of the heat source, v, and the slopes P_r and P_f on the rising and falling portions of the curve at the same temperature by the expression

$$D = \frac{v^2}{P_r + P_f} \tag{46}$$

f. Comparative Method

A comparative method employing transient heat flow was developed by Hsu [431, 432]. In this method, two identical sets of composite blocks are used. Each set consists of a test specimen and a reference sample whose properties are known. Initially, the two sets are heated separately to uniform but different temperatures, and then they are suddenly brought into contact, with the two test specimens touching each other. The transient temperature at the contact plane between the test specimen and reference sample corresponding to a certain time is measured, and from this the thermal diffusivity of the specimen can be calculated.

Another transient-heat-flow comparative method has been used by Deem *et al.* [433] for the measurements on irradiated materials. The method of measurement is to place the lower ends of a specimen and a reference sample, which are of the same size and initially at room temperature, in molten tin maintained at a constant elevated temperature and then measure the times required for the upper ends to reach a predetermined intermediate temperature. The ratio of the thermal diffusivities is assumed directly proportional to the ratio of the two times measured for the specimen and the reference material.

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Data Presentation and Related General Information

1. SCOPE OF COVERAGE

Presented in this volume are the thermal conductivity data for 69 elements, 172 nonferrous binary alloy systems, 80 nonferrous multiple alloy systems, 25 ferrous alloy systems, 60 intermetallic compounds, 16 mixtures of intermetallic compounds, and 13 miscellaneous alloys and mixtures. These data were obtained by processing over 2150 research documents on the thermal conductivity of metallic materials dated from around 1800 to 1967, of which 1000 contain usable data. Materials within each group are arranged in alphabetical order by name, as listed in the *Grouping of Materials and List of Figures and Tables* in the front of the volume. In all, this volume reports 5539 sets of data on 892 materials, which are listed in the *Material Index* at the end of the volume. The *Material Index* lists also the materials contained in the companion volumes (Volumes 2 and 3) on thermal conductivity.

In addition to metals, semimetals and semiconductors are included in this volume. Although a nonmetal, boron is also included because of its extensive use as an alloying element for metallic alloys. Of course, it is also contained in Volume 2, which covers nonmetals.

The temperature ranges covered by the thermal conductivity data for many materials are from near absolute zero to past the melting point, though for most high-temperature alloys the available data are limited to the solid range.

The data for the elements and a small number of alloys have been critically evaluated, analyzed, and synthesized, and recommended reference values are presented. This procedure involves critical evaluation of the validity of available data and related information, resolution and reconciliation of disagreements of conflicting data, correlation of data in terms of various affecting parameters, and comparison of the resulting values with theoretical predictions or with results derived from semi-theoretical relationships or from generalized empirical correlations. Besides critical evaluation and analysis of the existing data, thermodynamic principles and semi-empirical techniques are employed to fill in gaps and to extrapolate existing data so that the resulting recommended values are internally consistent and cover as wide a range of the controlling parameters as possible. Future editions of this volume will contain recommended values for an increasing number of materials.

2. PRESENTATION OF DATA

The thermal conductivity data and information on test specimens for each material are generally presented in three sections arranged in the following order: Original Data Plot, Specification Table, and Data Table. For the elements and a small number of alloys, a Graph and Table of Recommended Values is added as a fourth section. Furthermore, for a number of materials for which there exists only a small number of data, the Original Data Plot may be omitted.

The Original Data Plot is a full-page log–log-scale graphical presentation of the original thermal conductivity data as a function of temperature. When several sets of data are coincident, some of the data sets may be omitted from the plot for the sake of clarity. They are, however, reported in the Data Table and Specification Table.

The Specification Table provides in a concise form the comprehensive information on the test specimens for which the data are reported. The curve numbers in the Specification Table correspond exactly to the numbers which also appear in the Original Data Plot and in the Data Table. The Specification Table gives for each set of data the reference number which corresponds to the number in the list of References to Data Sources, the year of publication of the original data, the method of measurement, the temperature range, the reported estimate of error of the data, the specimen designation, and the specimen characterization and test conditions. The information of the last category, which is reported to the extent provided in the original source document, includes the following:

(1) Purity, chemical composition, carrier concentration;
(2) Type of crystal, crystal axis orientation, type and concentration of crystal defects;
(3) Microstructure, grain size, inhomogeneity, and additional phases;
(4) Specimen shape and dimensions, method and procedure of fabrication;
(5) Thermal history and cold work history, heat treatment, mechanical, irradiative, and other treatments;
(6) Manufacturer and supplier, stock number, and catalog number;
(7) Test environment, degree of vacuum or pressure, heat flow direction, strength and orientation of the applied magnetic field;
(8) Pertinent physical properties such as density, porosity, hardness, electrical resistivity (residual, ratio, and temperature variations), Lorenz function, transition temperatures, etc.;
(9) Reference material and its property values for a comparative method of measurement;
(10) Form in which the extracted data are presented in the original source document other than raw data points;
(11) Additional information obtained directly from the author.

Unfortunately, in the majority of cases the authors do not report in their research papers all the necessary pertinent information to fully characterize and identify the materials for which their data are reported. This is particularly true for the authors of earlier investigations. Consequently, the amount of information on specimen characterization reported in the Specification Tables varies greatly from specimen to specimen.

In the Data Table, tabular presentation is given for all the data described in the Specification Table and shown or not shown in the Original Data Plot. Many tabular data which are not presented in the original source documents have been obtained directly from the authors through private communications. Attempts have often been made to contact the authors for tabular data whenever the original data are given in the research paper only in a figure too small to warrant accurate data extraction compatible with the reported accuracy of the measurement. The thermal conductivity data are given in watts per centimeter per degree Kelvin, and the temperatures in degrees Kelvin. For data conversion, the reader is referred to the Conversion Factors for Thermal Conductivity Units given later.

The recommended thermal conductivity values for a material are reported in a separate graph and table following the Data Table. The estimated accuracy of the recommended values and special remarks on material characterization and identification are also noted in the table.

3. CLASSIFICATION OF MATERIALS

The classification scheme as shown in the table for the elements and alloys contained in this volume is based strictly upon the chemical composition of the material. This scheme is mainly for the convenience of materials grouping and data organization, and is not intended to be used as basic definitions for the various material groups.

4. SYMBOLS AND ABBREVIATIONS USED IN THE FIGURES AND TABLES

In the Specification Tables, the code designations used for the experimental methods are as follows:

C	Comparative method
E	Direct electrical heating method
F	Forbes' bar method
L	Longitudinal heat flow method
P	Periodic or transient heat flow method
R	Radial heat flow method
T	Thermoelectrical method

Other symbols and abbreviations used in the figures and/or tables are as follows:

b.c.c.	Body-centered cubic
c.	Cubic
c.p.h.	Close-packed hexagonal
d	Density
d.	Diamond (crystal structure)
Decomp.	Decomposition
f.c.c.	Face-centered cubic
f.c.t.	Face-centered tetragonal
h.	Hexagonal

Classification of Materials

Classification		Limits of composition (weight percent)*			
		X_1	$X_1 + X_2$	X_3	X_4
1. Metallic elements		>99.5	—	< 0.2	< 0.2
2. Nonferrous alloys ($X_1 \neq$ Fe)	A. Binary alloys	—	≥99.5	≥ 0.2	≤ 0.2
	B. Multiple alloys	—	≥99.5	> 0.2	> 0.2
		—	<99.5	≥ 0.2	≤ 0.2
		—	<99.5	> 0.2	> 0.2
		≤99.5	—	< 0.2	< 0.2

Classification			X_1	X_2	X_3	Mn, P, S, or Si
3. Ferrous alloys (X_1 = Fe)	A. Carbon steels	Group I	Fe	C ≤ 2.0	≤ 0.2	≤ 0.6
		Group II	Fe	C ≤ 2.0	≤ 0.2	> 0.6
			Fe	C ≤ 2.0	> 0.2	≤ 0.6
			Fe	C ≤ 2.0	> 0.2	> 0.6
	B. Cast irons	Group I	Fe	C > 2.0	≤ 0.2	≤ 0.6
		Group II	Fe	C > 2.0	≤ 0.2	> 0.6
			Fe	C > 2.0	> 0.2	≤ 0.6
			Fe	C > 2.0	> 0.2	> 0.6
	C. Alloy steels†	Group I	Fe	≠ C	≤ 0.2 and C ≤ 2.0	≤ 0.6
		Group II	Fe	≠ C	≤ 0.2	> 0.6
			Fe	≠ C	> 0.2	≤ 0.6
			Fe	≠ C	> 0.2	> 0.6

*$X_1 \geq X_2 \geq X_3 \geq X_4 \ldots$

†In case Mn, P, S, or Si represents X_2, this particular element is dropped from the last column. Alloy cast irons are also included in Group II of this category.

I.D.	Inside diameter
k	Thermal conductivity
M.P.	Melting point
monocl.	Monoclinic
NTP	Normal temperature and pressure
O.D.	Outside diameter
orthorh.	Orthorhombic
r.	Rhombohedral
s.c.	Superconducting
Subl.	Sublimation
T	Temperature
t.	Tetragonal
Temp.	Temperature
T.P.	Transition point
Vit.	Vitreous
ρ	Electrical resistivity
μ	Micro
>	Greater than
<	Less than
~	Approximately
3	Curve number
$\boxed{4}$	Single data point number

5. CONVENTION FOR BIBLIOGRAPHIC CITATION

For the following types of documents the bibliographic information is cited in the sequences given below.

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CONVERSION FACTORS FOR UNITS OF THERMAL CONDUCTIVITY

MULTIPLY ↓ by appropriate factor to OBTAIN →	$Btu_{IT}\,hr^{-1}\,ft^{-1}\,F^{-1}$	Btu_{IT} in. $hr^{-1}\,ft^{-2}\,F^{-1}$	$Btu_{th}\,hr^{-1}\,ft^{-1}\,F^{-1}$	Btu_{th} in. $hr^{-1}\,ft^{-2}\,F^{-1}$	$cal_{IT}\,sec^{-1}\,cm^{-1}\,C^{-1}$	$cal_{th}\,sec^{-1}\,cm^{-1}\,C^{-1}$	$kcal_{th}\,hr^{-1}\,m^{-1}\,C^{-1}$	$J\,sec^{-1}\,cm^{-1}\,K^{-1}$	$W\,cm^{-1}\,K^{-1}$	$W\,m^{-1}\,K^{-1}$	$mW\,cm^{-1}\,K^{-1}$
$Btu_{IT}\,hr^{-1}\,ft^{-1}\,F^{-1}$	1	12	1.00067	12.0080	4.13379×10^{-3}	4.13656×10^{-3}	1.48916	1.73073×10^{-2}	1.73073×10^{-2}	1.73073	17.3073
Btu_{IT} in. $hr^{-1}\,ft^{-2}\,F^{-1}$	8.33333×10^{-2}	1	8.33891×10^{-2}	1.00067	3.44482×10^{-4}	3.44713×10^{-4}	0.124097	1.44228×10^{-3}	1.44228×10^{-3}	0.144228	1.44228
$Btu_{th}\,hr^{-1}\,ft^{-1}\,F^{-1}$	0.999331	11.9920	1	12	4.13102×10^{-3}	4.13379×10^{-3}	1.48816	1.72958×10^{-2}	1.72958×10^{-2}	1.72958	17.2958
Btu_{th} in. $hr^{-1}\,ft^{-2}\,F^{-1}$	8.32776×10^{-2}	0.999331	8.33333×10^{-2}	1	3.44252×10^{-4}	3.44482×10^{-4}	0.124014	1.44131×10^{-3}	1.44131×10^{-3}	0.144131	1.44131
$cal_{IT}\,sec^{-1}\,cm^{-1}\,C^{-1}$	2.41909×10^{2}	2.90291×10^{3}	2.42071×10^{2}	2.90485×10^{3}	1	1.00067	3.60241×10^{2}	4.1868	4.1868	4.1868×10^{2}	4.1868×10^{3}
$cal_{th}\,sec^{-1}\,cm^{-1}\,C^{-1}$	2.41747×10^{2}	2.90096×10^{3}	2.41909×10^{2}	2.90291×10^{3}	0.999331	1	3.6×10^{2}	4.184	4.184	4.184×10^{2}	4.184×10^{3}
$kcal_{th}\,hr^{-1}\,m^{-1}\,C^{-1}$	0.671520	8.05824	0.671969	8.06363	2.77592×10^{-3}	2.77778×10^{-3}	1	1.16222×10^{-2}	1.16222×10^{-2}	1.16222	11.6222
$J\,sec^{-1}\,cm^{-1}\,K^{-1}$	57.7789	6.93347×10^{2}	57.8176	6.93811×10^{2}	0.238846	0.239006	86.0421	1	1	1×10^{2}	1×10^{3}
$W\,cm^{-1}\,K^{-1}$	57.7789	6.93347×10^{2}	57.8176	6.93811×10^{2}	0.238846	0.239006	86.0421	1	1	1×10^{2}	1×10^{3}
$W\,m^{-1}\,K^{-1}$	0.577789	6.93347	0.578176	6.93811	2.38846×10^{-3}	2.39006×10^{-3}	0.860421	1×10^{-2}	1×10^{-2}	1	10
$mW\,cm^{-1}\,K^{-1}$	5.77789×10^{-2}	0.693347	5.78176×10^{-2}	0.693811	2.38846×10^{-4}	2.39006×10^{-4}	8.60421×10^{-2}	1×10^{-3}	1×10^{-3}	0.1	1

d. Series, volume, and number—If the series is designated by a letter, no comma is used between the letter for series and the numeral for volume, and they are underlined together. In case series is also designated by a numeral, a comma is used between the numeral for series and the numeral for volume, and only the numeral representing volume is underlined. No comma is used between the numerals representing volume and number. The numeral for number is enclosed in parentheses.
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g. Pages
h. Year

6. CONVERSION FACTORS FOR THERMAL CONDUCTIVITY UNITS

The conversion factors given in the table on page 42a are based upon the following basic definitions:

1 in.	= 0.0254 (exactly) m*
1 lb	= 0.45359237 kg*
1 cal_{th}	= 4.184 (exactly) J*
1 cal_{IT}	= 4.1868 (exactly) J*
1 $Btu_{th}\ lb^{-1}\ F^{-1}$	= 1 $cal_{th}\ g^{-1}\ C^{-1}$†
1 $Btu_{IT}\ lb^{-1}\ F^{-1}$	= 1 $cal_{IT}\ g^{-1}\ C^{-1}$†

The subscripts "th" and "IT" designate "thermochemical" and "International Steam Table," respectively.

7. CRYSTAL STRUCTURES, TRANSITION TEMPERATURES, AND OTHER PERTINENT PHYSICAL CONSTANTS OF THE ELEMENTS

The table on the following pages contains information on the crystal structures, transition temperatures, and certain other pertinent physical constants of the elements. This information is very useful in data analysis and synthesis. For example, the thermal conductivity of a material generally changes abruptly when the material undergoes any transformation. One must therefore be extremely cautious in attempting to extrapolate the thermal conductivity values across any phase, state, magnetic, or superconducting transition temperature, as given in the table.

No attempt has been made to critically evaluate the temperatures/constants given in the table and they should not be considered recommended values. This table has an independent series of numbered references which immediately follows the table.

*National Bureau of Standards, "New Values for the Physical Constants Recommended by NAS-NRC," *NBS Tech. News Bull.*, 47 (10), 175-7, 1963.

†Mueller, E. F. and Rossini, F. D., "The Calory and the Joule in Thermodynamics and Thermochemistry," *Am. J. Phys.*, 12 (1), 1-7, 1944.

CRYSTAL STRUCTURES, TRANSITION TEMPERATURES, AND OTHER PERTINENT PHYSICAL CONSTANTS OF THE ELEMENTS

Name	Atomic Number	Atomic Weight[a]	Density,[b] kg m⁻³·10⁻³	Crystal Structure	Phase Transition Temp., K	Superconducting Transition Temp., K	Curie Temp., K	Néel Temp., K	Debye Temperature at 0 K, K	Debye Temperature at 298 K, K	Melting Point, K	Boiling Point, K	Critical Temp., K
Actinium	89	(227)	10.07[1c]	f.c.c.[2]					124[3]	100[4] (at~50 K)	1323[3]	3200±300[6]	
Aluminum	13	26.9815	2.702[6]	f.c.c.[7]		1.196[5] 1.17[8] 1.18[9]			423±5[3]	390[3]	933.2[3,19]	2723[20]	8650[11] 7740[100]
Americium	95	(243)	11.7[5]	Double c.p.h.[2]							1473[25]	2880[102]	
Antimony	51	121.75	6.684[29]	r.[2] (?) ? (?) ? (?)	357.3[13] (?-?) 690[13] (?-?)	2.6[8] (Sb II, high-pressure modification)			150[3]	200[14]	903.7[13] 903.65[22]	1907±10[3]	2989[15]
Argon	18	39.948	0.0017824[29] (at 273.2 K and 1 atm)	f.c.c.[16]						90[4] (at~45 K)	83.8[17]	87.29[13]	151[15]
Arsenic	33	74.9216	5.73[22] (gray, at 287.2 K) 4.7[23] (black) 2.0[23] (yellow)	r.[7] (gray) c.[3] (yellow)					236[3]	275[13]	1090[13] (35.8 atm) subl. 886[3]	1090[13] (35.8 atm)	
Astatine	85	(210)									573.2[19]	650[20]	
Barium	56	137.34	3.5[29]	b.c.c.[2] (α) ? (β)[13]	648[13,21] (α-β)				110.5±1.8[22]	116[23]	998.2[6]	1910[3]	3663[15] 3920[100]
Berkelium	97	(249)											
Beryllium	4	9.0122	1.85[29]	c.p.h.[2] (α) b.c.c.[2] (β)	1533[24] (α-β)	~6[100] ~8.4[100]			1160[25]	1031[3]	1550[26]	3142±100[3]	6153[15]
Bismuth	83	208.980	9.78[29]	r.[2]		3.9[8] (Bi II, at 25 kbar) 7.2[8] (Bi III, at 27 kbar)			119±2[3]	116±5[3]	544.525[3,111]	1824±8[3]	4620[27]
Boron	5	10.811	2.50[42]	Simple r.[2] (α) r.[2] (β)	1473[7] (α-β)				1315[13]	1362[3]	2573[6]	4060±100[30]	
Bromine	35	79.909	3.119[29]	orthorh.[16]							266.0[17]	331.93[29]	584[15]

[a] Atomic weights are based on $^{12}C = 12$ as adopted by the International Union of Pure and Applied Chemistry in 1961; those in parentheses are the mass numbers of the isotopes of longest known half-life.

[b] Density values are given at 293.2 K unless otherwise noted.

[c] Superscript numbers designate references listed at the end of the table.

Name	Atomic Number	Atomic Weight[a]	Density,[b] kg m^{-3}·10^{-3}	Crystal Structure	Phase Transition Temp., K	Superconducting Transition Temp., K	Curie Temp., K	Néel Temp., K	Debye Temperature at 0 K, K	Debye Temperature at 298 K, K	Melting Point, K	Boiling Point, K	Critical Temp., K
Cadmium	48	112.40	8.65[29]	c.p.h.[2] b.c.c.[4](?)		0.56[5] 0.52[9]			252 ± 48[3]	221[3] 170[4] (b.c.c., at ~85 K)	594.18[3,10] Subl.[13] 594.1 (at 0.11 mm Hg)	1038[3]	1903[15] 5560[100]
Calcium	20	40.08	1.55[29]	f.c.c.[7](α) b.c.c.[7](β)	737[42](α-β)				234 ± 5[3]	230[3]	1123[19] Subl. 1123[13] (at 0.35 mm Hg)	1765[3]	3267[15]
Californium	98	(251)											
Carbon (amorphous)	6	12.01115	1.8~2.1[29]								Subl.[5] 3925–3970	4473[5]	
Carbon (diamond)	6	12.01115	3.51[29]	d.[18]					2240 ± 5[31]	1874[3]	>3823[5]	5100[5]	
Carbon (graphite)	6	12.01115	2.26[29](α)	h.[2](α) r.[2](β)					402 ± 11[3]	1550[3]	Subl.[5] 3925–3970	4473[5]	
Cerium	58	140.12	6.90[29]	f.c.c.(α)[32] Double c.p.h.?[6](β) f.c.c.(γ)[32] b.c.c.(δ)[32]	103 ± 5[33](α-β) 263 ± 5[33](β-γ) 1003[32](γ-δ)			13[32]	146[3]	138[34]	1077[28]	3972[3]	10400[100]
Cesium	55	132.905	1.873[29]	b.c.c.[2]					40 ± 5[2]	43[23]	301.9[19] Subl. 301.9[13] (at 1.2 μHg)	939[35]	2060[113,114,115] 1900[100]
Chlorine	17	35.453	0.003214[29] (at 273.2 K)	t.[16]						115[4,36] (at ~58 K)	172.2[28]	239.10[13]	417[15]
Chromium	24	51.996	7.16[42]	c.p.h.[17,d](α) b.c.c.[2](β)	~299[17](α-β)[d]			311[37]	598 ± 32[3]	424[3]	2118[38]	2918 ± 35[3]	
Cobalt	27	58.9332	8.862[42]	c.p.h.[7](α) f.c.c.[17](β)	690[38](α-β)		1400[40]		452 ± 17[3]	386[3]	1765[3,19]	3229[3]	
Copper	29	63.54	[illegible]	f.c.c.[2]					342 ± 2[3]	310[3]	1356[3,10]	2811 ± 20[41]	8500[11] 8280[100]
Curium	96	(247)	7[43]	Double c.p.h.[6]									
Dysprosium	66	162.50	8.556[43]	c.p.h.[2](α) b.c.c.[2](β)	Near m.p.[2](α-β)			174[43] 83.5[43] (ferro-antiferromag.)	172 ± 35[3]	158[44]	1773[12]	3011[44]	7640[100]

[d]Close-packed hexagonal crystalline modification of chromium may be formed by electrodeposition below 293 K under special conditions of deposition process. This c.p.h. form is unstable and will irreversibly transform into b.c.c. form on heating.

Name	Atomic Number	Atomic Weight[a]	Density,[b] kg m^{-3} · 10^{-3}	Crystal Structure	Phase Transition Temp., K	Superconducting Transition Temp., K	Curie Temp., K	Néel Temp., K	Debye Temperature at 0 K, K	Debye Temperature at 298 K, K	Melting Point, K	Boiling Point, K	Critical Temp., K
Einsteinium	99	(254)											
Erbium	68	167.26	9.06[42]	c.p.h.[2] (α) b.c.c.[2] (β)	1643[2] (α-β)		19[4]	80[4]	134 ± 10[45]	163[44]	1770[24]	3000[3]	7250[100]
Europium	63	151.96	5.245[21]	b.c.c.[7]				~90[4]	127[3]		1099[6]	1871[48]	4600[100]
Fermium	100	(253)											
Fluorine	9	18.9984	0.001695[29] (at 273.2 K and 1 atm)	c.[101] (β-F_2)							53.58[8]	85.24[13]	144[15]
Francium	87	(223)							39[3]		300.2[19]	879[100]	
Gadolinium	64	157.25	7.87[42]	c.p.h.[2] (α) b.c.c.[2] (β)	1535[22] (α-β)		292[40]		170[3]	155 ± 3[3]	1579[19]	3540[3]	8670[100]
Gallium	31	69.72	5.91[29]	orthorh.[4] (α) t.[4] (β)	275.6[13] (α-β) (at 8.86 x 10^8 mm Hg)	1.091[5] 7.2[38] (Ga II, high-pressure modification)			317[3]	240[14] 125[4] (tetra at ~63 K)	302.93[6] 275.6[13] (at 8.86 x 10^8 mm Hg)	2510[3]	7620[27]
Germanium	32	72.59	5.36[29]	d.[7]		5.5[47] (at ~118 kbar) 8.4[104]			378 ± 22[3]	403[3]	1210.6[6]	3100[3]	5642[15]
Gold	79	196.967	19.3[42]	f.c.c.[7]					165 ± 1[3]	178 ± 8[3]	1336.2[3,10] 1336.15[22]	3240[3]	9500[11] 8060[100]
Hafnium	72	178.49	13.28[42]	c.p.h.[48] (α) b.c.c.[48] (β)	2023 ± 20[41] (α-β)	0.16[9] 0.35[104]			256 ± 5[3]	213[22]	2495[19]	4575 ± 150[40]	
Helium	2	4.0026	0.0001785[19] (at 273.2 K and 1 atm)	c.p.h.[18]						30[4] (at ~15 K)	3.45[29] 1.8 ± 0.2[17] (at 30 atm)	4.216[13] 4.22[23]	5.3[15]
Holmium	67	164.930	8.80[29]	c.p.h.[2] (α) b.c.c.[2] (β)	Near m.p.[50] (α-β)		20[4]	132[4]	114 ± 7[45]	161[44]	1734[19]	3228[51]	
Hydrogen	1	1.00797	0.00008987[29] (at 273.2 K and 1 atm)	c.p.h.[18]						116[79] (para., at ~58 K) 105[38] (ortho., at ~53 K)	13.8 ± 0.1[17]	20.39[13] 20.37[23]	33.3[15]
Indium	49	114.82	7.3[29]	f.c.t.[7]		3.4035[5]			108.8 ± 0.3[3]	129[14]	429.76[3,110]	2270 ± 6[3]	4377[15] 7050[100]
Iodine	53	126.9044	4.93[29]	orthorh.[18]						105[4] (at ~53 K)	386.8[29] subl. 298.16[13] (at 0.31 mm Hg)	457.50[29]	785[15]
Iridium	77	192.2	22.5[42]	f.c.c.[7]		0.14[5,9]			425 ± 5[3]	228[3]	2716[3,10]	4820 ± 30[3]	

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Name	Atomic Number	Atomic Weight[a]	Density,[b] kg m^{-3}·10^{-3}	Crystal Structure	Phase Transition Temp., K	Superconducting Transition Temp., K	Curie Temp., K	Néel Temp., K	Debye Temperature at 0 K, K	Debye Temperature at 298 K, K	Melting Point, K	Boiling Point, K	Critical Temp., K
Iron	26	55.847	7.87[29]	b.c.c.-ferromag.[7] (α) b.c.c.-paramag.[7] (β) f.c.c.[7] (γ) b.c.c.[7] (δ)	1183[7] (β-γ) 1673[12] (γ-δ)		1043[40]		457 ± 12[3]	373[3]	1810[18]	3160[30]	6750 ~~[illegible]~~ 9400[109]
Krypton	36	83.80	0.003708[29] (at 273.2 K and 1 atm)	f.c.c.[16]						60[4] (at ~30 K)	116.6[5]	119.93[13]	209.4[15]
Lanthanum	57	138.91	6.18[42]	Double c.p.h.[7] (α) f.c.c.[7] (β) b.c.c.[7] (γ)	583[22] (α-β) 1141[22] (β-γ)	4.9[6] (α) 6.3[6] (β)			142 ± 3[82]	135 ± 5[44]	1193[5]	3713 ± 70[3]	10500[109]
Lawrencium	103	(257)											
Lead	82	207.19	11.34[29]	f.c.c.[7]		7.193[6]			102 ± 5[3]	87 ± 1[3]	600.576[3,111]	2022 ± 10[41]	5400[27] 4760[109]
Lithium	3	6.939	0.534[29]	b.c.c.[7]	Martensitic transformation at low temp.[54]				352 ± 17[3]	448[3]	453.7[13]	1599[13]	4150[11] 3720[109]
Lutetium	71	174.97	9.85[29]	c.p.h.[7] (α) b.c.c.[7] (β)	Near m.p.[56] (α-β)				210[54]	116[3]	1923[19]	4140[3]	
Magnesium	12	24.312	1.74[29]	c.p.h.[7]					396 ± 54[3]	330[3]	923[14]	1385[3]	3530[109]
Manganese	25	54.9380	7.43(α)[28] 7.29(β)[29] 7.18(γ)[28]	~~[illegible]~~ b.c.c.(α)[48] c.[7] (β) ~~[illegible]~~ f.c.c.(γ)[43] b.c.c.[7] (δ)	1000[13] (α-β) 1374[13] (β-γ) 1410[13] (γ-δ)			95[6]	418 ± 32[3]	363[3]	1517 ± 3[6]	2360[13]	6050[109]
Mendelevium	101	(256)											
Mercury	80	200.59	13.546[29] 14.19[29] (at 234.25 K)	r.[7] (α) b.c.t.-pressure induced structure (β)	Martensitic transformation at low temp.[56]	4.153[6] (α) 3.949[6] (β)			~ 75[58]	92 ± 8[3]	234.28[3,10]	629.73[3,10]	1733[27] 1705[109]
Molybdenum	42	95.94	10.24[42]	b.c.c.[7]		0.92[6,9]			459 ± 11[3]	377[3]	2883[13]	5785 ± 175[3]	17000[11] 16600[109]
Neodymium	60	144.24	7.007[29]	Double c.p.h.[7] (α) b.c.c.[22] (β)	1135[22] (α-β)			8[4] (ordinary) 19[4] (special)	159[3]	148 ± 8[3]	1292[19]	2958[60]	7900[109]
Neon	10	20.183	0.0009002[29] (at 273.2 K and 1 atm)	f.c.c.[16]						60[4] (at ~30 K)	24.48[5]	27.23[6] 27.06[23]	44.5[15]

Name	Atomic Number	Atomic Weight[a]	Density,[b] kg m⁻³ · 10⁻³	Crystal Structure	Phase Transition Temp., K	Superconducting Transition Temp., K	Curie Temp., K	Néel Temp., K	Debye Temperature at 0 K, K	Debye Temperature at 298 K, K	Melting Point, K	Boiling Point, K	Critical Temp., K
Neptunium	93	(237)	20.46[42]	orthorh.[2] (α) t.[2] (β) b.c.c.[2] (γ)	551[2] (α-β) 813[2] (β-γ)				121[3]	163[3]	913.2[5]	4150[3]	
Nickel	28	58.71	8.90[42]	f.c.c.[7]			631[40]		427 ± 14[3]	345[3]	1726[3,10] 1726 ± 4[41]	3055[43]	6294[16] 11750[100]
Niobium	41	92.906	8.57[42]	b.c.c.[7]		9.13[5] 9.09[8] 9.1[9]			241 ± 13[3]	260[64]	2741 ± 27[3] 2688[65]	4813[64]	19000[100]
Nitrogen	7	14.0067	0.0012506[29]	c.[96] (α) h.[107] (β)	35.62[11] (α-β)					70[4] (at ~35 K)	63.29[5]	77.34[13,23]	126.2[15]
Nobelium	102	(254)											
Osmium	76	190.2	22.48[29]	c.p.h.[2]		0.655[5] 0.65[8]			500[67]	400[68]	3283 ± 10[69]	5300 ± 100[70]	
Oxygen	8	15.9994	0.001429[29] (at 273.2 K and 1 atm)	b.c.orthorh.[1] (α) r.[1] (β) c.[1] (γ)	23.876 ± 0.01[111] (α-β) 43.818 ± 0.01[112] (β-γ)					250[4] (at ~125 K) 500[36] (at ~250 K)	54.8[5]	90.19[13] 90.18[23]	154.8[15]
Palladium	46	106.4	12.02[29]	f.c.c.[2]					283 ± 16[3]	275[14]	1825[3,10]	3200[3]	
Phosphorus	15	30.9738	1.82[29] (β) 2.22[29] (γ) 2.69[29] (δ)	h. ?[7] (α) b.c.c.[7] (β) c.[7] (γ) f.c.orthorh.[17] (δ)	196[71] (α-β) 298.16[13] (β-γ) 298.16[13] (β-δ)				193[3] (white) 325[3] (red)	576[3] (white) 800[3] (red)	317.3[5] (white) 1300[72] (black)	553[13]	993.8[15]
Platinum	78	195.09	21.45[29]	f.c.c.[2]					234 ± 1[3]	225 ± 5[3]	2042[3,10]	4100[3]	8280[15]
Plutonium	94	(242)	19.737[29] (at 298.2 K)	Simple monocl.[2] (α) b.c. monocl.[2] (β) f.c.orthorh.[2] (γ) f.c.c.[2] (δ) b.c.t.[2] (δ') b.c.c.[2] (ε)	396.7[73] (α-β) 475[73] (β-γ) 591.4[73] (γ-δ) 729[73] (δ-δ') 757 ± 3[73] (δ'-ε)				171[74]	176[74]	912.7[5]	3727[75]	
Polonium	84	(210)	9.3[29] (α) 9.5[29] (β)	Simple c.[7] (α) r.[7] (β)	327 ± 1.5[76] (α-β)				81[3]		527.2[5]	1235[20]	2281[15]
Potassium	19	39.102	0.86[29]	b.c.c.[7]					89.4 ± 0.5[3]	100[3]	336.8[5]	1027[25]	2450[11] 2140[100]
Praseodymium	59	140.907	6.769[29]	Double c.p.h.[8] (α) b.c.c.[8] (β)	1071[32] (α-β)			25[77]	85 ± 1[46]	138[78]	1192 ± 2[79]	3616[80]	8900[100]

Name	Atomic Number	Atomic Weight[a]	Density[b], kg m^{-3} · 10^{-3}	Crystal Structure	Phase Transition Temp., K	Superconducting Transition Temp., K	Curie Temp., K	Néel Temp., K	Debye Temperature at 0 K, K	Debye Temperature at 298 K, K	Melting Point, K	Boiling Point, K	Critical Temp., K
Promethium	61	(145)		h.[1] (γ) b.c.c.[120] (β)	1185[120] (α-β)			6[120]			1353 ± 10[81]	2730[3]	
Protactinium	91	(231)	15.37[42]	b.c.t.[2]		1.4[f]			159[3]	262[3]	1503[6]	4680[3]	
Radium	88	(226)	5[29]						89[3]		973.2[5]	1900[3]	
Radon	86	(222)	0.00973[29] (at 273.2 K and 1 atm)	f.c.c.[f]						400[4] (at ~200 K)	202.2[5]	211[13]	377.16[15]
Rhenium	75	186.2	21.1[42]	c.p.h.[2]		1.698[26]			429 ± 22[3]	275[13]	3453[5]	6035 ± 135[3]	20000[11]
Rhodium	45	102.905	12.45[42]	f.c.c.[7]	possible transformation at 1373-1473 K[57]				480 ± 32[3]	350[3]	2233[3,10,62]	3960 ± 60[3]	
Rubidium	37	85.47	1.53[29]	b.c.c.[2]					54 ± 4[3]	59[23]	312.04[5]	959[35]	2100[13,115,116] 2030[100]
Ruthenium	44	101.07	12.2[29]	c.p.h.[7] (α) ? (β) ? (γ) ? (δ)	1308[13,121] (α-β) 1473[13,121] (β-γ) 1773[13,121] (γ-δ)	0.49[5,8]			600[67]	415[3]	2523 ± 10[69]	4325 ± 25[3]	
Samarium	62	150.35	7.54[29]	r.[32] (α) b.c.c.[32] (β)	1190[32] (α-β)		14[8]	106[8]	116[48]	184 ± 4[3]	1345.2[63]	2140[3]	5400[100]
Scandium	21	44.956	3.00[42]	c.p.h.[2] (α) b.c.c.[2] (β)	1607[2] (α-β)				470 ± 80[52]	476[3]	1812[5]	3537 ± 30[3]	
Selenium	34	78.96	4.50[29] (α) 4.80[29] (β)	monocl.[7] (α) h.[7] (β) amorphous[7]	304[64,111] (vitrification) 398[13] (vit.-β) 423[13] (α-β)	7.3[86] (at ~118 kbar)			151.7 ± 0.4[86]	89[36] (at ~45 K) 150[4] (at ~75 K)	490.2[5]	1009[13] (Se_6) 958.0[13] ($Se_{4.37}$) 1027[13] (Se_2)	1757[15]
Silicon	14	28.086	2.33[42]	d.[7]		7.5[87] (at 118-128 kbar)			647 ± 11[3]	692[3]	1685 ± 2[67]	2753[28]	5159[15]
Silver	47	107.870	10.5[29]	f.c.c.[2]					228 ± 3[3]	221[3]	1234.0[3,13]	2468 ± 15[41]	7460[11]
Sodium	11	22.9898	0.9712[29]	b.c.c.[2]	Martensitic transformation at low temp.[36]				157 ± 1[3]	155 ± 5[3]	371.0[13]	1154[36]	2800[11] 2400[100]
Strontium	38	87.62	2.60[29]	f.c.c.[38] (α) c.p.h.[7] (β) b.c.c.[7] (γ)	488[38] (α-β) 878[38] (β-γ)				147 ± 1[22]	148[23]	1042[5]	1645[3]	3059[15] 3810[109]
Sulfur	16	32.064	2.07[29] (α) 1.96[29] (β)	r.[7] (α) monocl.[7] (β)	368.6[13] (α-β)				200[3] (β)	527[20] (α) 250[20] (α, at 40 K)	386.0[5] (α) 392.2[5] (β) Subl. 368.6[13] (at 0.0047 mm Hg)	717.75[3,10]	1313[15]
Tantalum	73	180.948	16.6[42]	b.c.c.[2]		4.483[6] 4.48[9]			247 ± 13[3]	225[14]	3269[6]	5760 ± 60[3]	22000[11]

Name	Atomic Number	Atomic Weight[a]	Density,[b] $kg\ m^{-3} \cdot 10^{-3}$	Crystal Structure	Phase Transition Temp., K	Superconducting Transition Temp., K	Curie Temp., K	Neel Temp., K	Debye Temperature at 0 K, K	Debye Temperature at 298 K, K	Melting Point, K	Boiling Point, K	Critical Temp., K
Technetium	43	(99)	11.50[29]	c.p.h.[2]		8.22[6] 11.2[8]			351[3]	422[3]	2473 ± 50[6]	5300[3]	
Tellurium	52	127.60	6.24[29](α) 6.00[8](amorph.)	h.[7](α) ? (β)[7] amorph.[8]	621[13](α-β)	3.3[8](Te II, at 56 kbar)			141 ± 12[3]		722.7[6]	1163 ± 1[3]	2329[15]
Terbium	65	158.924	8.25[29]	c.p.h.[2,32](α) b.c.c.[2](β)	Near m.p.[2](α-β)		219[30]	230[30]	150[91]	158[44]	1629[10]	3810[3]	
Thallium	81	204.37	11.85[29]	c.p.h.[2](α) b.c.c.[2](β)	508.3[6](α-β)	2.39[5] 2.38[8] 2.37[9]			88 ± 1[3]	96[14]	576.2[19]	1939[92]	3219[15]
Thorium	90	232.038	11.7[42]	f.c.c.[2](α) b.c.c.[2](β)	1673 ± 25[93](α-β)	1.368[5] 1.37[9]			170[94]	100[14]	2023[19]	4500[20]	14550[100]
Thulium	69	168.934	9.32[29]	c.p.h.[2](α) b.c.c.[2](β)	Near m.p.[90](α-β)		22[96] (ferro.-antiferro.)	53[96]	127 ± 1[65]	167[44]	1818[6]	2266[97]	6430[100]
Tin	50	118.69	5.750[29](α) 7.31[29](β)	f.c.c.[7](α) b.c.t.[7](β) r.[29](γ)	286.2 ± 3[98](α-β)	3.722[5](β)			236 ± 24[3] (gray) 196 ± 9[3] (white)	254[3](gray) 170[14](white)	505.06[3,10]	2766 ± 14[3]	8000[21] 9300[100]
Titanium	22	47.90	4.5[29]	c.p.h.[7](α) b.c.c.[7](β)	1155[13](α-β)	0.39[5,9]			426 ± 5[3]	380[14]	1953[99]	3586[100]	
Tungsten	74	183.85	19.3[29]	b.c.c.[2]		0.011[172]			388 ± 17[3]	312 ± 3[3]	3653[3,10,23]	6000 ± 200[3]	23000[11]
Uranium	92	238.03	19.07[29]	orthorh.[7](α) t.[7](β) b.c.c.[7](γ)	37 ± 2[118](α_0-α) 938[13](α-β) 1049[13](β-γ)	0.68[5](α) 1.80[5](γ)			200[94]	300[3]	1405.6 ± 0.6[101]	3950 ± 250[102]	12500[27] 12000[100]
Vanadium	23	50.942	6.1[18]	b.c.c.[2]		5.3[5] 5.03[9]			326 ± 54[3]	390[14]	2192 ± 2[61]	3582 ± 42[3]	11200[100]
Xenon	54	131.30	0.005851[29] (at 273.2 K and 1 atm)	f.c.c.[18]							161.2[26]	165.1[13]	289.75[15]
Ytterbium	70	173.04	7.02[42]	f.c.c.[32](α) b.c.c.[32](β)	1071[2,5](α-β)				118[103]		1097[12]	1970[3]	4420[100]
Yttrium	39	88.905	4.47[29]	c.p.h.[32](α) b.c.c.[32](β)	1753[113](α-β)				268 ± 32[3]	214[104]	1798[112]	3670[105]	8950[100]
Zinc	30	65.37	7.140[29]	c.p.h.[2]		0.875[5] 0.85[9]			316 ± 20[3]	237 ± 3[3]	692.655[3,110]	1175[100]	2169[15] 2910[100]
Zirconium	40	91.22	6.57[19]	c.p.h.[7](α) b.c.c.[7](β)	1135[13](α-β)	0.546[5] 0.55[9]			289 ± 24[3]	250[14]	2125[19]	4650[24]	12300[100]

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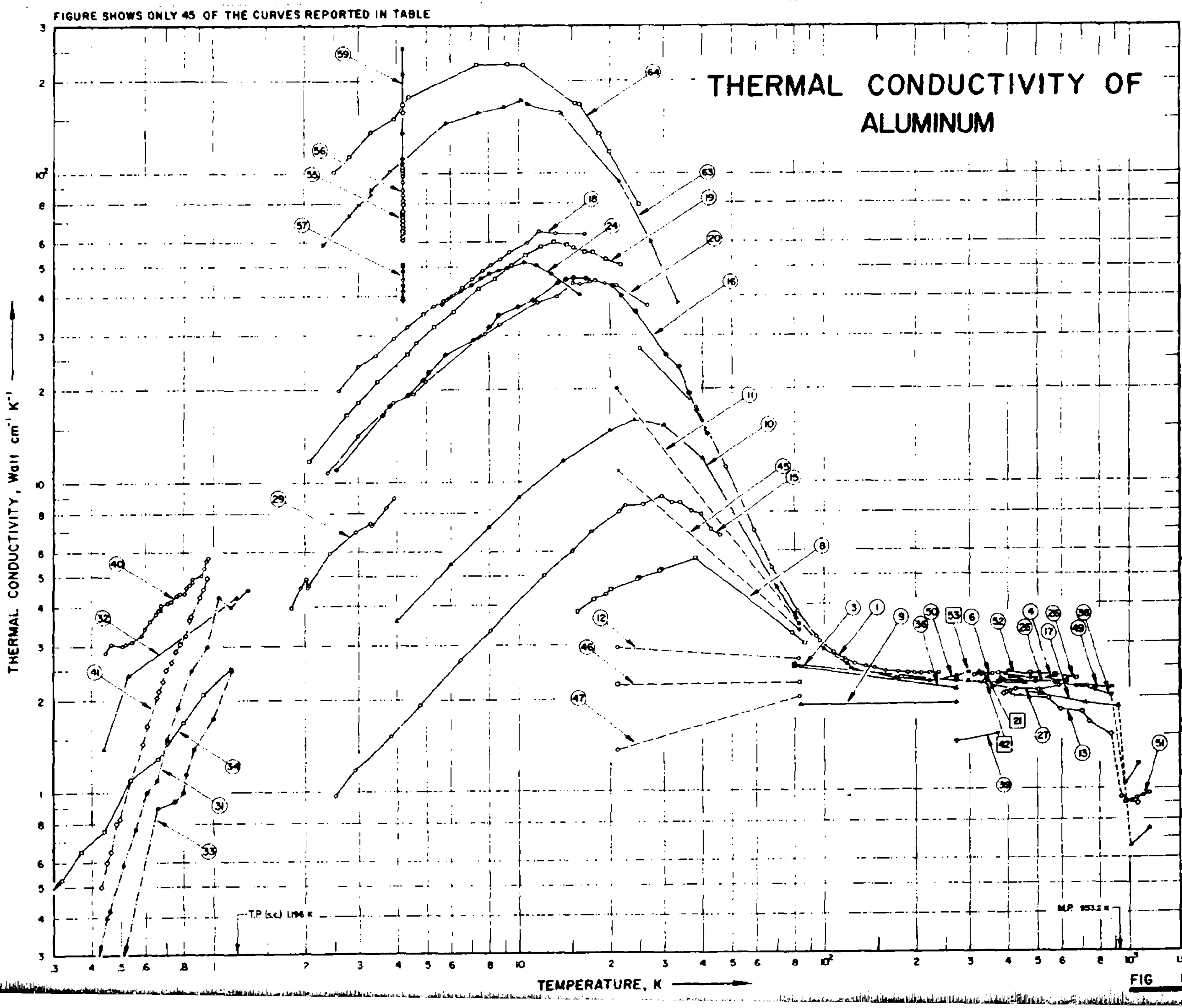


FIGURE SHOWS ONLY 45 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF ALUMINUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P. (s.c.) 1.196 K
M.P. 933.2 K

FIG 1

SPECIFICATION TABLE NO. 1 THERMAL CONDUCTIVITY OF ALUMINUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 1]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	114	L	1950	25-238	0.6-1.8		99.99$^+$ pure; 0.5 in. dia x 20 in. long; supplied by Aluminum Company of America; cold-drawn with 55% reduction in dia; measured in a vacuum of $< 10^{-5}$ mm Hg.
2	504	P	1961	295.2	±5		Pure; 1.9 x 1.9 x 0.352 cm; thermal conductivity value calculated from measured data of thermal diffusivity and heat capacity and the density value take from Smithsonian Physical Tables (9th ed., 1954).
3	850, 93	L	1929	80-460	3-4		Extremely pure; electrical resistivity reported as 0.725, 2.700, 3.922, and 5.160 μohm cm at 89, 273, 374, and 476 K, respectively.
4	20	L	1951	379-570	3		99.92 Al, 0.04 Si, 0.03 Fe, 0.006 Cu, 0.005 Ti; annealed at 450 C.
5	53	E	1927	353-423	1		High purity.
6	17	L	1958	311-357	2		99.986 Al, 0.0062 Si, 0.0045 Fe, 0.003 Cu, and 0.0001 Mg; 50 mm dia x 70 mm high; manufactured by Metallgesellschoft AG; density 2.691 g cm^{-3} at 20 C.
7	491	C	1948	94-147			99.99$^+$ pure; supplied by Aluminum Company of America; aluminum used as comparative material.
8	104	L	1951	16-87			High purity; as rolled; measured in a vacuum of $< 5 \times 10^{-6}$ mm Hg.
9	619	L	1916	85, 273			Commercial aluminum; 0.5 cm dia x 5 cm long; measured in vacuum.
10	524	L	1957	4.0-120		JM 340	99.995 pure; single crystal; specimen axis inclined 6°, 40°, and 50° to [001], [011], and [111] direction, respectively; a rod of dia 3.68 mm made by Horizons Inc.; ground down to 3.66 mm in dia, then annealed in vacuum at ~400 C for two hours; electrical resistivity reported as 0.025, 0.026, 0.028, 0.065, 0.45, and 2.7 μohm cm at 4, 10, 20, 40, 100, and 300 K, respectively.
11	57	L	1927	21, 83		Al-1	Pure; 7 cm long bar specimen obtained from Aluminum Company of America; annealed in vacuo at 300 C for 2.5 hrs; electrical resistivity reported as 0.0188, 0.3065, and 2.50 μohm cm at -252, -190, and 0 C, respectively.
12	57	L	1927	21, 83		Al-100	Commercial aluminum; annealed in vacuo at 250 C; electrical resistivity reported as 0.1577, 0.458, and 2.65 μohm cm at -252, -190, and 0 C, respectively.
13	85	L	1919	389-1073			Pure.
14	127	L	1925	382-645			99.7 pure; supplied by British Aluminum Co., Ltd.; billets 6.75 in. in dia cast from a maximum temperature of 700 C, annealed at 500 C for 2.5 hrs, extruded at 420 C to 0.75 in. dia, then annealed at 450 C for 2.5 hrs; density 2.70 g cm^{-3} at 21 C; electrical resistivity reported as 2.83, 2.79, 2.81, 3.45, 3.53, 3.53, 4.47, 4.48, 6.15, 6.23, 6.24, 7.39, 8.77, 8.79, and 9.31 μohm cm at 16.2, 16.8, 16.8, 73.0, 77.0, 79.0, 160.0, 161.0, 302.7, 304.4, 306.2, 399.0, 500.0, 502.4, and 540.7 C, respectively.
15	97	L	1952	2.5-46	2-3	JM 4899	99.994 pure; polycrystalline; 1 ~ 2 mm dia x 5 cm long; supplied by Johnson-Matthey Co.; annealed.

SPECIFICATION TABLE NO. 1 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
16	122	-	1955	2.6-42	3	JM-4899	99.994 pure; polycrystalline; 0.394 mm dia x 2.97 cm long; supplied by Johnson-Matthey Co.; annealed in vacuum at 600 C for several hrs; electrical resistivity ratio $\rho(293\ K)/\rho(20\ K) = 279$.
17	15	F	1947	298-1173	1-5	Al-1	99.95 pure; 2.[illegible] cm dia x 25 [illegible]m long.
18	3	L	1951	2.6-17	4	Al-1	99.996$^+$ Al, 0.001 Mg, 0.001 Si, 0.0006 Fe, 0.0004 Cu, and 0.0004 Na; single crystal; 0.15 in. dia x 4 in. long; supplied by Aluminum Company of America; residual electrical resistivity $\rho_r = 0.00304\ \mu$ohm cm; electrical resistivity ratio $\rho(273\ K)/\rho(4.2\ K) = 840$.
19	3	L	1951	2.1-22	4	Al-2	Similar to the above specimen except $\rho_r = 0.00385\ \mu$ohm cm and $\rho(273\ K)/\rho(4.2\ K) = 676$.
20	3	L	1951	2.4-27	4	Al-3	99.995$^+$ Al, 0.002 Mg, 0.001 Si, traces of Fe, Cu, and Na; polycrystal, same dimensions and supplier as the above specimen; $\rho_r = 0.00553\ \mu$ohm cm; $\rho(273\ K)/\rho(4.2\ K) = 467$.
21	276	C	1953	343.2	3	25-Al	Density 2.7 g cm^{-3}; Armco iron used as comparative material.
22	230	L	1925	326			99.97$^+$ pure; 1.9 cm dia x 10 cm long; electrical conductivity 33.8 x 10^4 ohm^{-1}cm^{-1} at 23 C.
23	400	L	195[illegible]	0.36-0.81		Al-2	Polycrystalline; in superconducting state.
24	404	L	1950	2.6-16	4		99.996$^+$ pure; single crystal; supplied by Aluminum Company of America; machined and then etched; crystal slightly damaged by machining.
25	405	E	1940	398-583	± 1		99.992 Al, 0.0030 Fe, 0.0027 Si, and 0.0024 Cu; cast at 700 C in a mold and cooled to 200 C, rolled to 15 mm dia, drawn to 12.5 mm dia, then reduced to 6.5 mm dia.
26	405	E	1940	383-628	± 1		99.93 Al, 0.038 Fe, 0.03 Si, and 0.0022 Cu; same fabrication method as above.
27	405	E	1940	399-623	± 1		99.5 Al, impurities unknown; same fabrication method as above.
28	406	C	1922	313.2	5		99.7 pure; cylindrical specimen of 3 cm long; zinc used as comparative material.
29	498	L	1955	1.8-3.9			99.998 pure; 2.00 mm dia x 9.88 cm long; annealed in vacuo for 5 hrs at 500 C.
30	410	R	1935	273.2	1	Al-1	99.7 pure; electrical conductivity 37.10 x 10^4 ohm^{-1}cm^{-1} at 0 C.
31	409	L	1958	0.13-1.3	10	Al-1	0.01 impurity; with large crystals; annealed in vacuum for 4 hrs at about 600 C; measured in a magnetic field of 0.2 oersted; in superconducting state.
32	409	L	1958	0.44-2.2	10	Al-1	The above specimen in normal state; measured in a longitudinal magnetic field of 115 oersted.
33	409	L	1958	0.16-1.2	10	Al-2	Same specification as the above specimen Al-1; in superconducting state.
34	409	L	1958	0.21-1.2	10	Al-2	The above specimen in normal state.
35	495	L	1949	38-238			99.99$^+$ pure; 0.5 in. rod specimen; supplied by Aluminum Company of America; cold-drawn.
36	496	C	1940	80,273	1		Pure; 4.00 mm dia x 60.0 mm long.
37	497	L	1949	25-82			99.99$^+$ pure; supplied by Aluminum company of America; cold-drawn.

SPECIFICATION TABLE NO. 1 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
38	490	F	1950	273-1073			99.996 pure; tube specimen of 1.2 in. long with a bore of 0.25 in.; manufactured from Norton's RA 98 material.
39	706	L	1891	273, 373			Electrical conductivity 22.46 and 17.31 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively (the author reported 22.46 and 17.31 x 10^5 $ohm^{-1}cm^{-1}$, probably a typographical error).
40	736	L	1965	0.45-0.97			Pure aluminum wire; in normal state.
41	736		1965	0.43-0.96			The above specimen measured in superconducting state.
42	591	C	1963	338.2	± 0.4		0.15 U; 0.500 in. dia x 3 in. long; prepared by dissolution of reactor grade uranium (99.5^+ pure) in aluminum (99.99 pure) at ~ 100 C above the alloy liquidus temperatures, cast in a graphite mould at 100 C, machined to required dimensions; measured in a vacuum of < 5 x 10^{-4} mm Hg; copper used as comparative material.
43	591	C	1963	338.2			Similar to above except specimen heat treated at 620 C for 5 days.
44	591	C	1963	338.2	± 1.4		99.99 pure; extruded.
45	57	L	1927	21.83		Al-3	From same cast piece as Al-1 (curve 11); drawn and annealed 2.5% stretched, recrystallized by annealing; grain size 5 to 15 mm long; electrical resistivity reported as 0.0351, 0.319, and 2.52 μohm cm at -252, -190, and 0 C, respectively.
46	57	L	1927	21.83		Al-191	Same material as Al-100 (curve 12); tempered then 3% stetched, recrystallized by annealing; thermal conductivity measuring length = 2 crystal grains; electrical resistivity reported as 0.219, 0.525, and 2.72 μohm cm at -252, -190, and 0 C, respectively.
47	57	L	1927	21.83		Al-21	Moderately pure; single crystal; grown by recrystallization; electrical resistivity reported as 0.340, 0.663, and 2.84 μohm cm at -252, -190, and 0 C, respectively.
48	659	C	1965	313-673		S. P.	S. P. (super pure) aluminum rod from British Aluminum Co.; specimen 2.53 cm in dia and 20.4 cm long; electrical resistivity reported as 2.86 and 7.12 μohm cm at 40 and 400 C, respectively; Armco iron used as comparative material.
49	659	L	1965	323-873		S. P.	S. P. (super pure) aluminum; 99.993 pure; from British Aluminum Co.; specimen 2.31 cm in dia and 28.0 cm long; electrical resistivity reported as 2.98 and 9.92 μ ohm cm at 50 and 600 C, respectively.
50	659	L	1965	123-323		S. P.	S. P. (super pure) aluminum from British Aluminum Co.; specimen 8.0 x 0.44 x 0.44 cm; electrical resistivity reported as 0.74 and 3.02 μohm cm at -150 and 50 C, respectively.
51	658	C	1965	973-1273		S. P.	S. P. (super pure) aluminum from British Aluminum Co.; in molten state; electrical resistivity reported as 26.3 and 30.9 μohm cm at 700 and 1000 C, respectively; Morgan Crucible Co. grade EY 9 graphite used as compartive material.
52	617		1957	338-797			99.99 pure; polycrystal; electrical resistivity reported as 3.15, 4.65, 6.82, and 9.14 μohm cm at 64.8, 184, 357.8, and 523.4 C, respectively; Lorenz function reported as 2.34, 2.40, 2.39, and 2.41 x 10^{-8} V^2K^{-2} at 64.8, 184, 357.8, and 523.4 C, respectively.

SPECIFICATION TABLE NO. 1 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
53	765	C	1957	298.2			Super-pure; thermal comparator applied on the machined curved surface of the 1 in. dia bar specimen.
54	765	C	1957	298.2			Thermal comparator loaded with 100 gram weight a on the plane lapped surface of the specimen.
55	330	L	1965	4.2	2-3	Sp 1	80 x 5 x 0.066 mm; made from a zone-refined material, cold-rolled and then annealed in air for 24 hrs at 460-500 C; electrical resistivity reported as 0.000538 μohm cm at 4.2 K; measured in magnetic fields of strength ranging from 0.94 to 12.8 kOe perpendicular to the specimen surface.
56	330	L	1965	4.2	2-3	Sp 1	The above specimen measured in transverse co-planar magnetic fields of strength ranging from 0 to 13.0 kOe.
57	330	L	1965	4.2	2-3	Sp 2	80 x 5 x 0.035 mm; same source and fabrication method as the above specimen; electrical resistivity reported as 0.00103 μohm cm at 4.2 K; measured in magnetic fields of strength ranging from 0 to 12.7 kOe perpendicular to the specimen surface.
58	330	L	1965	4.2	2-3	Sp 2	The above specimen measured in transverse co-planar magnetic fields of strength ranging from 0 to 12.8 kOe.
59	330	L	1965	4.2	2-3	Sp 3	80 x 5 x 0.129 mm; same source and fabrication method as the above specimen; electrical resistivity reported as 0.000402 μ ohm cm at 4.2 K; measured in magnetic fields of strength ranging from 0 to 10.7 kOe perpendicular to the specimen surface.
60	330	L	1965	4.2	2-3	Sp 3	The above specimen measured in transverse co-planar magnetic fields of strength ranging from 0 to 5.98 kOe.
61	330	L	1965	4.2	2-3	Sp 4	80 x 5 x 0.081 mm; same source and fabrication method as the above specimen; bulk electrical resistivity reported as 0.000595 μohm cm at 4.2 K; measured in magnetic fields of strength ranging from 0 to 13.2 kOe perpendicular to the specimen surface.
62	330	L	1965	4.2	2-3	Sp 4	The above specimen measured in transverse co-planar magnetic fields of strength ranging from 0 to 10.3 kOe.
63	570	L	1963	2-33	1.5	Al_3	99.9999 pure; specimen made from zone-refined Al, 0.125 in. in dia and about 6 cm long; supplied by Consolidated Mining and Smelting Co. of Canada; drawn and etched; residual electrical resistivity ρ_o 0.000903 μohm cm.
64	570	L	1963	3-25	1.5	Al_4	Similar to the above specimen except ρ_o 0.000568 μohm cm.
65	843	P	1966	298.2			Grained ingot supplied by Alcoa Aluminum Co.; mesh size -30 + 45; specimen contained in a 0.75 in. dia x 2 in. long stainless steel cylindrical cell; thermal conductivity measured by using the transient line source method; measured in argon under a pressure of ~ 100 psig.
66	843	P	1966	298.2			Similar to above; measured in nitrogen under a pressure of ~100 psig.

DATA TABLE NO. 1 THERMAL CONDUCTIVITY OF ALUMINUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

	T	k
CURVE 1	25.1	26.9
	38.3	17.2
	47.8	11.2
	59.2	6.98
	67.8	5.28
	82.1	3.81
	94.4	3.16
	97.0	3.06
	107.7	2.91
	107.8	2.80
	117.6	2.67
	129.7	2.58
	138.1	2.52
	147.2	2.49
	159.6	2.44
	175.4	2.41
	188.0	2.39
	197.7	2.39
	208.3	2.39
	222.3	2.39
	237.7	2.39
CURVE 2*	295.2	2.22
CURVE 3	80.0	2.56
	273.0	2.26
	373.0	2.22
	400.0	2.20
CURVE 4	379.2	2.29
	473.2	2.29
	570.2	2.33
CURVE 5*	353.2	2.09
	373.2	2.14
	393.2	2.22
	423.2	2.33
CURVE 6	311.3	2.34
	312.7	2.34
	316.1	2.34
	320.6	2.35
	328.1	2.34
	337.7	2.35
	342.2	2.35
	357.2	2.35
CURVE 7*	94.3	3.12
	107.7	2.80
	117.6	2.66
	126.7	2.57
	138.0	2.51
	147.1	2.47
CURVE 8	15.7	3.82
	17.8	4.17
	19.3	4.33
	20.1	4.50
	24.6	4.83
	24.8	4.90
	29.2	5.16
	29.5	5.21
	38.0	5.65
	58.8	3.25
	86.7	3.00
CURVE 9	81.8	1.90
	273.0	1.93
CURVE 10	4	3.58
	6	5.42
	8	7.22
	10	8.95
	14	11.8
	20	14.8
	24	15.8
	30	15.3
	40	12.0
	70	4.51
	80	3.70
	100	2.88
	120	2.57
CURVE 11	21.2	20.0
	83.2	3.46
CURVE 12	21.2	2.93
	83.2	2.57
CURVE 13	280.2	2.05
	516.2	1.97
	597.2	1.82
	703.2	1.78
	743.2	1.65
	873.2	1.51
	948.2	0.933
	1073.2	0.890
CURVE 14*	381.9	2.21
	401.8	2.23
	422.6	2.20
	427.2	2.21
	527.2	2.24
	645.3	2.27
CURVE 15	2.52	0.974
	2.91	1.18
	3.84	1.53
	4.77	1.92
	6.49	2.68
	8.08	3.34
	12.2	5.00
	15.0	6.00
	17.4	6.92
	21.5	8.03
	22.3	8.42
	25.6	8.47
	29.5	8.95
	31.9	8.58
	33.9	8.58
	36.8	8.05
	39.6	7.90
	42.9	7.05
	45.8	6.71
CURVE 16	2.55	11.1
	3.60	16.5
	3.80	17.7
	4.35	19.1
	4.90	21.4
	5.10	22.6
	5.80	25.8
CURVE 16 (cont.)	7.15	28.9
	8.00	32.0
	8.60	34.9
	10.0	36.9
	11.3	38.8
	13.5	44.2
	14.4	45.4
	15.2	45.9
	16.7	45.6
	20.3	43.3
	21.9	40.0
	24.3	35.7
	30.6	25.7
	33.7	23.5
	36.3	19.3
	38.5	17.0
	41.8	14.3
CURVE 17	298.2	2.25
	513.2	2.04
	523.2	2.04
	723.2	1.90
	923.2	1.86
	1013.2	0.600
	1173.2	0.750
CURVE 18	2.59	19.8
	3.00	23.7
	3.42	25.5
	3.95	29.2
	4.35	32.0
	4.92	35.2
	5.30	37.0
	5.70	38.6
CURVE 18 (cont.)	6.58	42.8
	7.05	45.3
	7.64	48.3
	8.14	50.6
	8.75	52.8
	9.33	55.4
	10.7	59.1
	11.8	64.9
	13.3	63.7
	16.6	63.4
CURVE 19	2.07	11.8
	2.75	16.6
	3.00	18.1
	3.47	21.1
	4.35	25.9
	4.65	28.2
	5.30	32.0
	6.17	35.7
	7.40	42.3
	8.35	45.4
	9.48	50.3
	10.6	54.3
	11.9	57.9
	13.1	59.9
	14.5	58.9
	15.2	57.4
	16.5	55.9
	17.6	55.4
	19.4	52.8
	21.8	50.3
CURVE 20	2.38	10.8
	3.00	14.2
CURVE 20 (cont.)	3.90	18.1
	4.55	19.4
	5.00	21.1
	7.77	30.2
	8.70	32.5
	11.6	38.0
	13.5	39.8
	15.1	44.0
	16.0	43.8
	17.2	44.5
	17.9	45.0
	19.2	44.0
	21.0	43.3
	26.6	37.2
CURVE 21	343.2	2.27
CURVE 22*	326.0	2.11
CURVE 23*	0.36	0.0063
	0.37	0.0068
	0.38	0.0070
	0.41	0.0077
	0.44	0.0089
	0.53	0.0120
	0.575	0.0121
	0.65	0.015
	0.71	0.020
	0.76	0.0445
	0.81	0.0695

* Not shown on plot

DATA TABLE NO. 1 (continued)

T	k
CURVE 24	
2.56	20.0*
3.07	23.6*
3.44	26.7*
3.49	27.1*
3.90	29.4*
4.00	30.0*
4.35	31.6*
4.51	34.3*
4.89	34.7*
5.13	35.7*
5.25	36.7*
5.35	37.2*
5.48	36.8*
5.63	37.6
6.56	41.4
7.00	43.5
7.55	45.8
8.08	47.5
8.64	48.5
9.23	49.5
10.5	51.5
11.6	51.1
12.9	47.2
15.9	40.4
CURVE 25*	
398.2	2.29
481.2	2.29
583.2	2.27
CURVE 26	
388.2	2.25
443.2	2.23
496.2	2.22
584.2	2.23
628.2	2.25
CURVE 27	
[illegible]	2.06
410.2	2.07
428.2	2.11
508.2	2.09
591.2	2.16
623.2	2.27

T	k
CURVE 28*	
313.2	2.18
CURVE 29	
1.81	3.95
1.93	4.59
2.03	4.89
2.04	4.57
2.05	4.68
2.42	5.96
2.94	6.95
3.28	7.42
3.31	7.35
3.68	8.35
3.92	8.95
CURVE 30*	
273.2	2.27
CURVE 31	
0.13	0.00041
0.15	0.00080*
0.17	0.0014*
0.21	0.0032*
0.23	0.0043*
0.25	0.0105*
0.25	0.012*
0.27	0.033*
0.30	0.051
0.33	0.090*
0.36	0.14
0.40	0.26
0.42	0.28
0.45	0.40
0.46	0.42
0.51	0.59
0.56	0.77
0.61	1.00
0.66	1.10
0.71	1.50
0.77	1.90
0.85	2.50
0.96	3.0
1.05	4.3
1.15	4.0
1.30	4.5

T	k
CURVE 32	
0.44	1.4
0.74	2.4
1.20	4.3
CURVE 33	
0.16	0.00083*
0.17	0.00084*
0.17	0.0011*
0.175	0.0014*
0.18	0.0013*
0.205	0.00185*
0.21	0.0024*
0.22	0.0044*
0.24	0.0088*
0.27	0.021*
0.32	0.031*
0.36	0.090*
0.39	0.14
0.41	0.15*
0.41	0.20
0.46	0.22
0.52	0.32
0.66	0.90
0.75	0.94
0.80	1.00
0.82	1.15
0.87	1.40
1.00	1.75
1.15	2.50
CURVE 34	
0.205	0.36*
0.28	0.46*
0.32	0.53
0.37	0.65
0.44	0.76
0.54	1.10
0.66	1.30
0.80	1.70
0.93	2.10
1.15	2.50

T	k
CURVE 35*	
38.4	17.2
47.8	11.1
59.3	7.01
67.9	5.31
82.1	3.82
94.3	3.12
97.0	3.05
107.7	2.80
107.7	2.78
117.6	2.66
126.7	2.57
138.0	2.51
147.1	2.47
155.5	2.42
175.0	2.41
187.9	2.40
197.6	2.38
208.2	2.37
222.2	2.37
237.6	2.37
CURVE 36	
80.2	2.53
273.2	2.13
CURVE 37*	
25.0	27.0
38.0	17.4
48.5	10.9
59.5	7.11
68.0	5.23
82.0	3.77
CURVE 38	
273.2	2.39
373.2	2.34
473.2	2.28
573.2	2.21
673.2	2.15
773.2	2.08
873.2	2.01
973.2	1.03
1073.2	1.21

T	k
CURVE 39	
273.2	1.437
373.2	1.514
CURVE 40	
0.445	2.85
0.465	3.05
0.505	3.00
0.505	2.99*
0.52	3.05
0.542	3.10
0.585	3.25
0.598	3.40
0.623	3.60
0.653	3.80
0.665	3.90
0.675	3.90
0.675	4.05
0.71	4.10
0.73	4.15
0.765	4.35
0.780	4.40
0.81	4.40
0.815	4.60
0.82	4.55*
0.845	4.70
0.855	4.80
0.855	4.90
0.915	5.05
0.935	5.35
0.95	5.65
0.965	5.75
CURVE 41	
0.43	0.50
0.45	0.60
0.465	0.65
0.485	0.80
0.495	0.83
0.59	1.45
0.61	1.65
0.655	2.05
0.665	2.15
0.685	2.30
0.70	2.50
0.73	2.65
0.755	2.88

T	k
CURVE 41 (cont.)	
0.78	3.05
0.815	3.25
0.835	3.65
0.845	3.73
0.91	4.30
0.925	4.55
0.955	4.95
CURVE 42	
338.2	2.23
CURVE 43*	
338.2	2.25
338.2	2.21
CURVE 44*	
338.2	2.26
CURVE 45	
21.2	11.9
83.2	3.45
CURVE 46	
21.2	2.13
83.2	2.45
CURVE 47	
21.2	1.37
83.2	2.08
CURVE 48*	
313.2	2.38
373.2	2.39
473.2	2.38
573.2	2.34
673.2	2.29

T	k
CURVE 49	
323.2	2.40
373.2	2.40*
473.2	2.375*
573.2	2.335*
673.2	2.275*
773.2	2.205*
873.2	2.135
CURVE 50	
123.2	2.485
173.2	2.30
223.2	2.25
273.2	2.315
323.2	2.415*
CURVE 51	
973.2	0.90
1023	0.916
1073	0.932
1123	0.948
1173	0.964
1223	0.98*
1273	0.988*
CURVE 52	
338.0	2.552*
401.6	2.406
457.2	2.377*
553.0	2.268*
631.0	2.188*
730.2	2.155
796.6	2.109*
CURVE 53	
298.2	2.39
CURVE 54*	
298.2	2.40

* Not shown on plot

DATA TABLE NO. 1 (continued)

CURVE 55 (T = 4.2K)

H x 10⁻³ (Oersted)	k
0	158*
0.94	79.1
1.38	70.8*
1.95	67.7*
2.05	66.6*
2.64	66.4*
3.27	68.2
3.32	66.7
3.98	69.7
4.42	69.7
4.61	71.5*
5.32	73.5
5.62	75.2*
6.12	75.4
6.77	72.3
8.27	64.3*
9.03	62.0*
9.71	60.9
10.2	61.9*
10.8	62.4
12.1	63.8
12.2	64.6*
12.8	65.2

CURVE 56 (T = 4.2K)

H x 10⁻³ (Oersted)	k
0	153*
0.106	141*
0.273	118*
0.879	84.5
1.42	79.8*
1.79	81.5
2.50	88.0
2.98	93.5
3.61	98.0
4.38	98.7*
5.29	99.6
6.91	103
8.33	104*
9.83	105*
11.4	104
13.0	105

CURVE 57 (T = 4.2K)

H x 10⁻³ (Oersted)	k
0	104*
0.543	61.4*
1.34	49.7*
2.09	41.8*
2.77	33.2
3.49	38.5
4.80	38.5
5.63	40.4*
6.17	40.6*
6.43	41.4
7.43	43.2
8.34	45.1
9.03	47.4*
9.20	48.0
10.2	50.1*
11.2	50.9
12.0	59.7*
12.7	49.6

CURVE 58* (T = 4.2K)

H x 10⁻³ (Oersted)	k
0	191
0.143	99.3
0.686	71.1
1.34	54.0
2.43	51.0
2.80	51.8
3.86	55.8
4.71	59.4
5.69	66.4
6.57	70.3
7.66	71.8
9.20	73.7
10.4	74.4
11.5	75.1
12.8	75.4

CURVE 59 (T = 4.2K)

H x 10⁻³ (Oersted)	k
0	254
0.109	210
0.527	130

CURVE 59 (cont.)

H x 10⁻³ (Oersted)	k
1.09	112
1.60	108
1.97	108
2.98	111*
3.47	110*
3.93	106
4.54	102
5.03	102*
5.48	102
6.04	104*
6.72	105
7.12	103*
7.51	102*
7.83	101*
8.22	98.2*
8.74	98.7*
9.05	99.0*
9.55	100*
9.97	100*
10.3	99.0*
10.7	97.6*

CURVE 60* (T = 4.2K)

H x 10⁻³ (Oersted)	k
0	256
0.085	224
0.302	172
0.450	150
0.597	158
1.05	135
1.37	134
1.56	136
1.91	136
2.24	135
3.86	136
5.98	136

CURVE 61* (T = 4.2K)

H x 10⁻³ (Oersted)	k
0	185
0.309	123
0.926	93.6
1.78	85.5

CURVE 61 (cont.)*

H x 10⁻³ (Oersted)	k
2.64	85.0
3.44	87.2
4.11	90.1
4.91	89.7
5.70	86.2
6.51	82.2
7.36	80.5
7.95	80.3
8.94	81.3
9.53	82.0
10.4	82.4
11.4	80.4
12.3	78.5
13.2	76.7

CURVE 62* (T = 4.2K)

H x 10⁻³ (Oersted)	k
0	182
0.444	118
0.728	101
1.14	94.7
1.37	96.0
1.91	107
2.58	119
3.43	121
4.25	123
5.15	124
6.23	127
8.37	129
10.3	128

CURVE 63

T	k
2.3	59
2.8	73
3.0	79
3.3	85
3.3	88
3.8	101
5.8	145
7.4	157
9.0	164

CURVE 63 (cont.)

T	k
10.2	172
10.8	168
13.5	157
21.6	94
27.3	60
33.4	38

CURVE 64

T	k
2.5	101
2.8	114
3.3	136
3.9	151
4.2	167
4.4	177
7.3	225
9.2	226
10.4	224
15.4	169
15.9	168
18.5	134
19.9	117
24.8	79

CURVE 65*

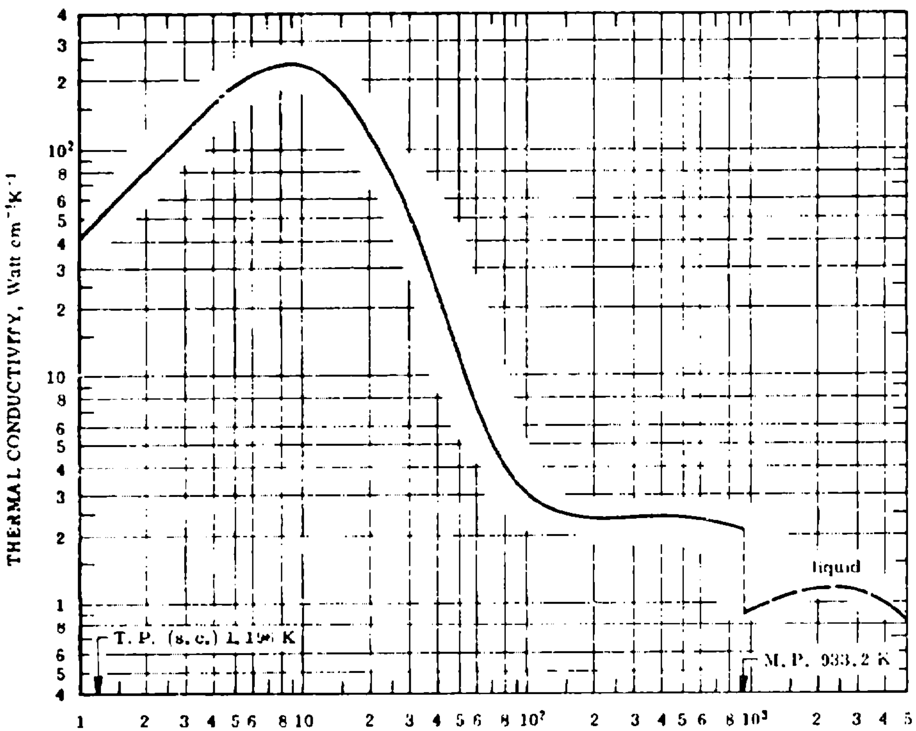
T	k
298.2	0.00255

CURVE 66*

T	k
298.2	0.00364

*Not shown on plot

FIGURE AND TABLE NO. 1R RECOMMENDED THERMAL CONDUCTIVITY OF ALUMINUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	41.2	2380	-457.9
2	82.0	4740	-456.1
3	121	6990	-454.3
4	157	9070	-452.5
5	188	10900	-450.7
6	213	12300	-448.9
7	229	13200	-447.1
8	238	13800	-445.3
9	240	13900	-443.5
10	235	13600	-441.7
11	227	13100	-439.9
12	215	12400	-438.1
13	202	11700	-436.3
14	189	10900	-434.5
15	176	10200	-432.7
16	163	9420	-430.9
18	138	7970	-427.3
20	117	6760	-423.7
25	77.3	4470	-414.7
30	51.8	2990	-405.7
35	34.9	2020	-396.7
40	23.8	1380	-387.7
45	16.8	971	-378.7
50	12.3	711	-369.7
60	7.54	436	-369.7
70	5.32	307	-333.7
80	4.14	239	-315.7
90	3.44	199	-297.7
100	3.02	174	-279.7
150	2.48	143	-189.7
200	2.37	137	- 99.7
250	2.35	136	- 9.7
273.2	2.36	136	32.0
300	2.37	137	80.3
350	2.40	139	170.3
400	2.40	139	260.3

T_1	k_1	k_2	T_2
500	2.37	137	440.3
600	2.32	134	620.3
700	2.26	131	800.3
800	2.20	127	980.3
900	2.13	123	1160
933.2	2.11	122	1220
In Liquid State			
933.2	0.907	52.4	1220
1000	0.930	53.7	1340
1100	0.964	55.7	1520
1200	0.994	57.[illegible]	1700
1300	(1.02)‡	([illegible].9)	1880
1400	(1.05)	(60.7)	2060
1500	(1.07)	(61.8)	2240
1600	(1.09)	(63.0)	2420
1700	(1.11)	(64.1)	2600
1800	(1.12)	(64.7)	2780
1900	(1.13)	(65.3)	2960
2000	(1.14)	(65.9)	3140
2200	(1.15)	(66.4)	3500
2400	(1.15)	(66.4)	3860
2600	(1.15)	(66.4)	4220
2800	(1.14)	(65.9)	4580
3000	(1.13)	(65.3)	4940
3200	(1.11)	(64.1)	5300
3400	(1.09)	(63.0)	5660
3600	(1.06)	(61.2)	6020
3800	(1.03)	(59.5)	6380
4000	(0.997)	(57.6)	6740
4500	(0.912)	(52.7)	7640
5000	(0.818)	(47.3)	8540
5500	(0.719)	(41.5)	9440
6000	(0.614)	(35.5)	10340
7000	(0.392)	(22.6)	12140
8000	(0.156)	(9.01)	13940
8650	(~0)	(~0)	15110

REMARKS

The recommended values are for well-annealed 99.9999% pure aluminum with residual electrical resistivity ρ_0 = 0.000593 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, a = 0.61, m = 2.61, α'' = 4.87 x 10^{-6}, and β = 0.0245. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 2 to 3% of the true values near room temperature and 3 to 5% at other temperatures.

*T_1 in K, k_1 in Watt $cm^{-1} K^{-1}$, T_2 in F, and k_2 in Btu $lb^{-1} ft^{-1} F^{-1}$.

‡Values in parentheses are extrapolated or estimated.

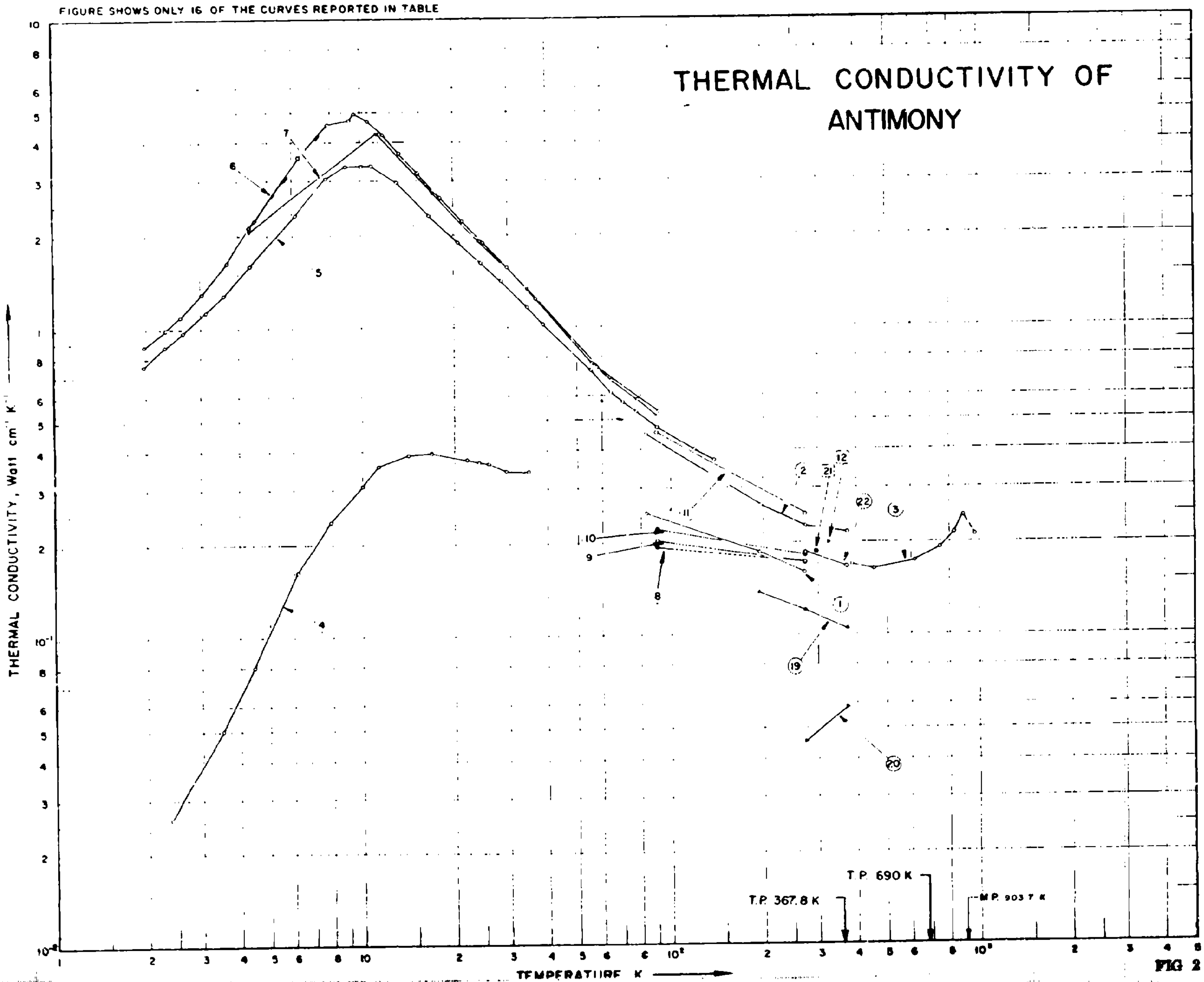


FIGURE SHOWS ONLY 16 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF ANTIMONY
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE K
T.P. 367.8 K
T.P. 690 K
M.P. 903.7 K

FIG 2

SPECIFICATION TABLE NO. 2 THERMAL CONDUCTIVITY OF ANTIMONY

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 2]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	35	L	1912	83-273			Pure; cold-drawn.
2	49	L	1913	83-373			Pure.
3	85	L	1919	386-965			No details reported.
4	122	L	1955	2.4-35		Sb 1	Polycrystalline; extruded wire; 1.625 cm long, 0.163 cm dia; made from Johnson Matthey Spectrographically Standardized Metals; annealed at 500 C in vacuo for 2 hrs.
5	424	L	1956	2.0-133		Sb 1	High purity polycrystalline specimen; 0.43 x 0.25 x 6 cm; sawn from a lump of extra high purity grade antimony supplied by Bradley Mining Co.; electrical resistivity 47.7 μohm cm at 295 K; residual electrical resistivity 0.057 μohm cm.
6	424	L	1958	2.0-91		Sb 2	High purity polycrystalline specimen; 5 mm dia, 6 cm long; crystal width 2 to 5 mm; supplied by Bradley Mining Co.; prepared by zone-refining high purity grade antimony; annealed at 600 C for one wk; electrical resistivity 41.3 μohm cm at 295 K; residual electrical resistivity 0.054 μohm cm.
7	424	L	1958	4.4-91		Sb 2a	Second run of the above specimen.
8	425	L	1924	90, 273	5		Polycrystalline specimen with fine grains; cast at 200 C; electrical conductivity at 90 and 273 K being 8.34 and 2.43 x 10^4 ohm^{-1} cm^{-1} respectively.
9	425	L	1924	90, 273	5		Polycrystalline specimen with fine grains; electrical conductivity at 90 and 273 K being 8.13 and 2.38 x 10^4 ohm^{-1} cm^{-1} respectively.
10	425	L	1924	90, 273	5		Polycrystalline specimen with medium size grains; electrical conductivity at 90 and 273 K being 8.08 and 2.35 x 10^4 ohm^{-1} cm^{-1} respectively.
11	425	L	1924	90, 273	5		Polycrystalline specimen with coarse grains; electrical conductivity at 90 and 273 K being 7.89 and 2.32 x 10^4 ohm^{-1} cm^{-1} respectively.
12	230	L	1925	327.2			Total impurity less than .03%; made from Baker's Analyzed Metal.
13	426	L	1947	91.2		P_I	Single crystal cylinder specimen; longitudinal axis of the specimen parallel to the z-axis of the crystal; supplied by Kahlbaum; electrical resistivity 26.26 μohm cm at 0 C; measured at 91.2 K in magnetic fields ranging from 0 to 11.6 kilooersteds.
14	426	L	1947	79.5		P_I	The above specimen similarly measured at a temp of 79.5 K.
15	426	L	1947	91.2		S 14	Similar to the above specimen except longitudinal axis of the specimen perpendicular to z- and x-axis of the crystal; electrical resistivity 37.11 μohm cm at 0 C; measured at 91.2 K.
16	426	L	1947	79.5		S 14	The above specimen similarly measured at 79.5 K.
17	426	L	1947	91.2		S 10	Similar to the above specimen except longitudinal axis perpendicular to z-axis and parallel to x-axis of the crystal; measured at 91.2 K in magnetic fields of 0 to 11.6 kilooersteds.

SPECIFICATION TABLE NO. 2 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
18	426	L	1947	81.2		S 10	The above specimen similarly measured at a temp of 81.2 K.
19	577	L	1913	193-373			Specimen pressed from powder at 5000 Kg cm^{-2} for 1 hr; antimony supplied by C. A. F. Kahlbaum.
20	577	L	1913	273, 373			Similar to the above specimen except pressed at 2500 Kg cm^{-2} for 1 hr.
21	511	L	1918	297			Specimen 0.45 cm dia; supplied by Erba; measured under 1.0 atm pressure.
22	706	L	1881	273, 373			Electrical conductivity at 273 and 373 K being 2.199 and 1.522 x 10^4 ohm^{-1} cm^{-1} respectively (the paper gives electrical resistivity values as 2.199 and 1.522 x 10^5 ohm^{-1} cm^{-1}, obviously a typographical error).
23	838	C	1967	825-1023			Molten metal placed in a hole 21 mm in dia drilled in an asbestos cement cylinder 30 mm in height; steel 1Kh18N9T used as comparative material.
24	319, 320	P	1966	1073.2	8		Molten specimen contained in a thin-walled stainless steel cylindrical crucible of dimensions 24 mm dia x 100 mm long; electrical resistivity reported as 82.9, 90.2, and 100 µohm cm at 620, 700, and 800 C respectively; thermal conductivity values calculated from measured thermal diffusivity and the specific heat data using the density data taken from Bienias, A. and Sauerwald, F. (Z. Anorg. Chem., 41, 51, 1927).

DATA TABLE NO. 2 THERMAL CONDUCTIVITY OF ANTIMONY

(Impurity <0.20 each; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
83.2	0.248
194.2	0.186
273.2	0.159

CURVE 2

T	k
83.2	0.444
196.2	0.263
273.2	0.225
373.2	0.215

CURVE 3

T	k
386.2	0.168
455.2	0.162
617.2	0.173
742.2	0.191
830.2	0.213
883.2	0.241
965.2	0.210

CURVE 4

T	k
2.36	0.026*
3.49	0.050*
4.42	0.080*
6.16	0.162
7.90	0.236
10.00	0.308
11.30	0.356
14.10	0.386
16.75	0.392
21.90	0.374
23.95	0.366
25.70	0.362
29.30	0.342
34.70	0.340

CURVE 5

T	k
1.96	0.753*
2.30	0.874*
2.63	0.977*
3.14	1.13*
3.58	1.28*
4.36	1.59*
6.13	2.32*
7.74	3.04*
8.92	3.32*
10.10	3.34*
10.88	3.35*
13.17	2.95*
16.85	2.30*
20.7	1.89*
24.5	1.61*
28.5	1.41*
34.0	1.16*
38.9	1.02*
55.1	0.72*
64.3	0.61*
70.5	0.57
77.8	0.53
90.8	0.47
120.0	0.40
138.0	0.37

CURVE 6

T	k
1.97	0.873*
2.31	0.992*
2.59	1.097*
3.05	1.30*
3.68	1.62*
4.35	2.14*
4.51	2.22*
6.36	3.59*
7.87	4.54*
9.22	4.69*
9.56	4.92*
10.6	4.68*
11.9	4.21*

CURVE 6 (cont.)

T	k
13.45	3.66*
15.3	3.17*
18.1	2.62*
21.4	2.22*
24.9	1.88*
29.7	1.56*
36.7	1.23*
55.9	0.76*
64.6	0.67*
78.1	0.58
91.0	0.51

CURVE 7

T	k
4.35	2.07*
11.4	4.26*
17.2	2.74*
24.0	1.93*
34.5	1.34*
58.0	0.74*
91.2	0.53

CURVE 8

T	k
90	0.1925
273	0.1716

CURVE 9

T	k
90	0.2025
273	0.1716

CURVE 10

T	k
90	0.2205
273	0.1320

CURVE 11

T	k
90	0.4519
273	0.2452

CURVE 12

T	k
327.2	0.201

CURVE 13*
(T = 91.2K)
(kilooersteds)

H	k
0	0.448
5.65	0.421
10.1	0.390
11.6	0.379

CURVE 14*
(T = 79.5K)
(kilooersteds)

H	k
0	0.490
3.43	0.471
6.75	0.439
10.1	0.413
11.6	0.403

CURVE 15*
(T = 91.2K)
(kilooersteds)

H	k
0	0.458
3.43	0.451
8.7	0.425
10.1	0.419
11.6	0.414

CURVE 16*
(T = 79.5K)
(kilooersteds)

H	k
0	0.520
5.65	0.493
8.7	0.472
10.1	0.464

CURVE 17*
(T = 91.2K)
(kilooersteds)

H	k
0	0.462
5.65	0.451
10.1	0.426
11.6	0.420

CURVE 18*
(T = 81.2K)
(kilooersteds)

H	k
0	0.517
5.65	0.495
10.1	0.467
11.6	0.461

CURVE 19

T	k
193	0.127
273	0.121
373	0.105

CURVE 20

T	k
273	0.0456
373	0.0582

CURVE 21

T	k
297	0.186

CURVE 22

T	k
273	0.185
373	0.166

CURVE 23

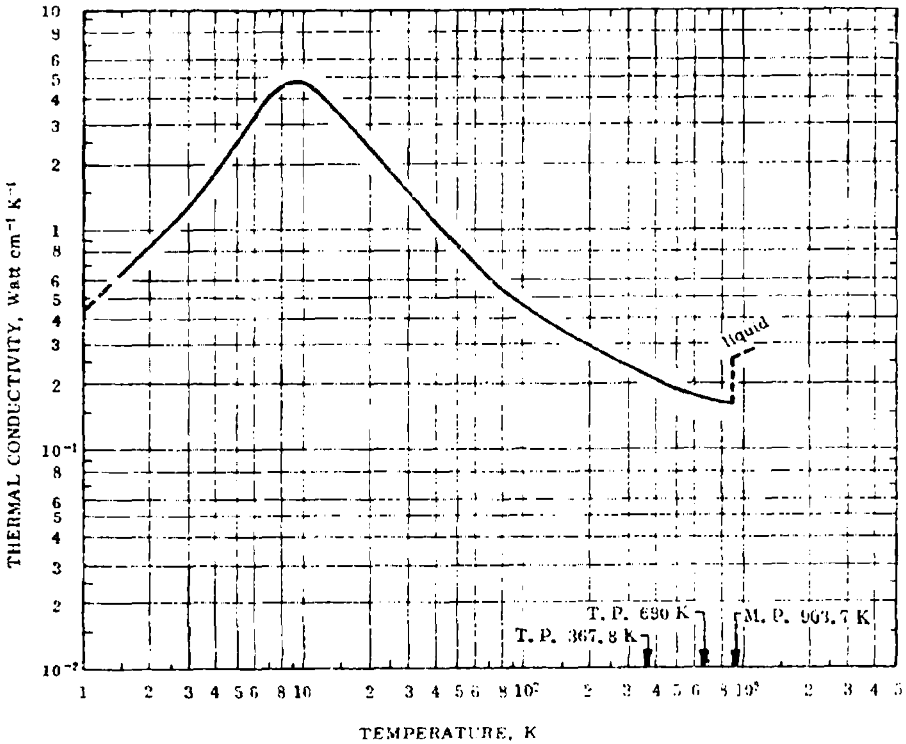
T	k
825.2	0.1674
851.2	0.1674
884.2	0.1716
305.2	0.2553
927.2	0.2637
970.2	0.2679
1023.2	0.2721

CURVE 24

T	k
1073.2	0.304

* Not shown on plot

FIGURE AND TABLE NO. 2R RECOMMENDED THERMAL CONDUCTIVITY OF ANTIMONY



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.430)‡	(24.8)	-457.9
2	0.853	49.3	-456.1
3	1.28	74.0	-454.3
4	1.84	106	-452.5
5	2.58	149	-450.7
6	3.34	193	-448.9
7	4.06	235	-447.1
8	4.63	268	-445.3
9	4.89	283	-443.5
10	4.80	277	-441.7
11	4.50	260	-439.9
12	4.07	235	-438.1
13	3.79	219	-436.3
14	3.51	203	-434.5
15	3.25	188	-432.7
16	3.04	176	-430.9
18	2.67	154	-427.3
20	2.38	138	-423.7
25	1.87	108	-414.7
30	1.54	89.0	-405.7
35	1.30	75.1	-396.7
40	1.13	65.3	-387.7
45	0.994	57.4	-378.7
50	0.883	51.0	-369.7
60	0.725	41.9	-351.7
70	0.620	35.8	-333.7
80	0.550	31.8	-315.7
90	0.500	28.9	-297.7
100	0.464	26.8	-279.7
150	0.356	20.6	-189.7
200	0.302	17.4	- 99.7
250	0.267	15.4	- 9.7
273.2	0.255	14.7	32.0
300	0.243	14.0	80.3
350	0.226	13.1	170.3
400	0.212	12.2	260.3

T_1	k_1	k_2	T_2
500	0.194	11.2	440.3
600	0.182	10.5	620.3
700	0.174	10.1	800.3
800	0.168	9.71	980.3
900	0.167	9.65	1160
903.7	0.167	9.65	1167
In Liquid State			
903.7	0.259	15.0	1167
1000	0.270	15.6	1340
1100	(0.280)	(16.2)	1520

REMARKS

The recommended values are for well-annealed high-purity antimony with residual electrical resistivity ρ_0 = 0.054 μΩ cm (characterization by ρ_0 becomes important below room temperature). The values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

THERMAL CONDUCTIVITY OF ARSENIC

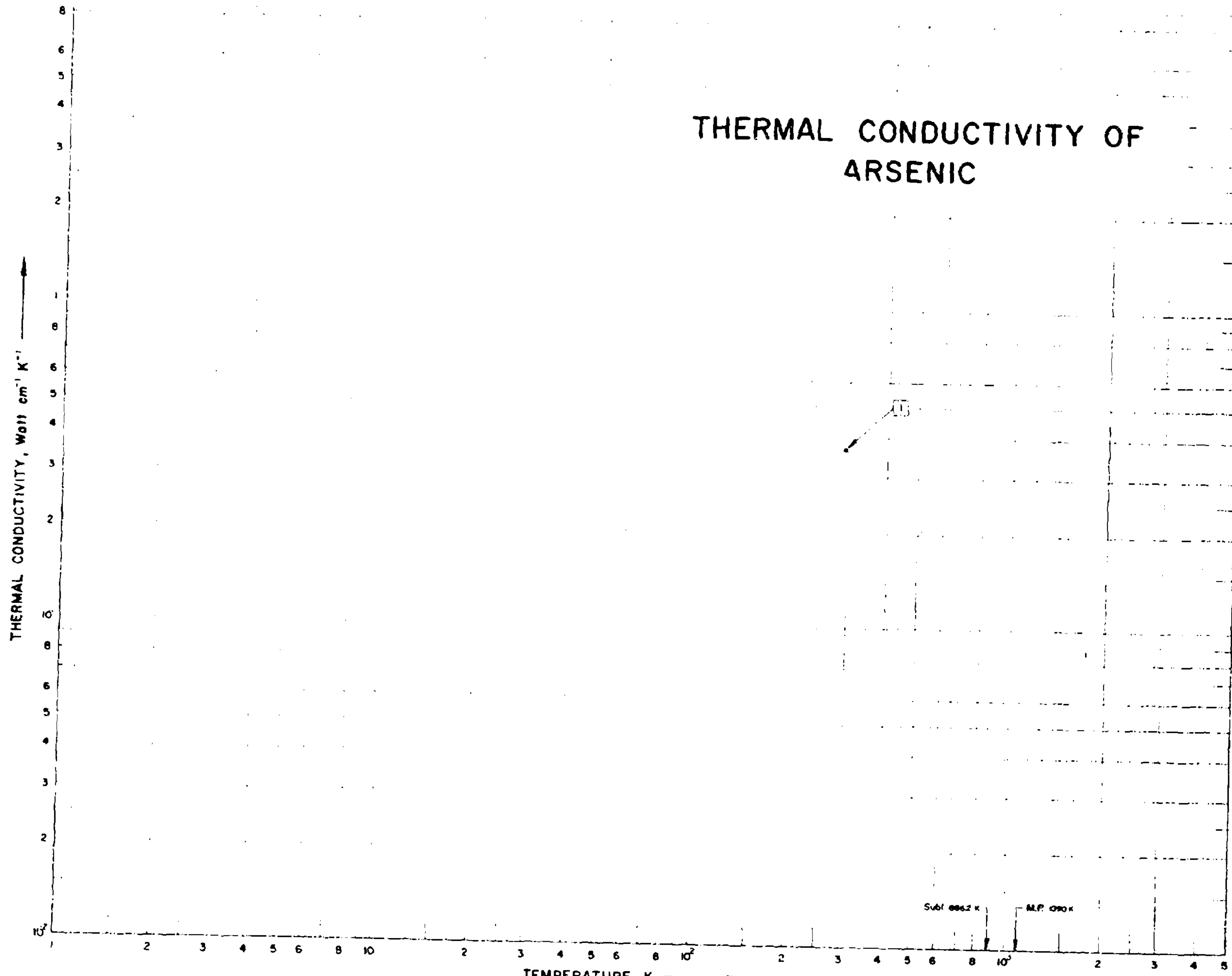


FIG 3

SPECIFICATION TABLE NO. 3 THERMAL CONDUCTIVITY OF ARSENIC

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 3]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	813	E	1926	293.2			Polycrystalline; specimen dimensions 2.7 x 1.1 x 0.02 cm obtained by distilling rough crystal in vacuum at about 400 C, the deposit on the containing glass tube polished and smoothed to size; electrical resistivity 46 μohm cm at 20 C; measured in magnetic fields of 4000 and 8000 gauss which were found to have no effect on the thermal conductivity.

DATA TABLE NO. 3 THERMAL CONDUCTIVITY OF ARSENIC

(Impurity <0.20% each; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
293.2	0.368

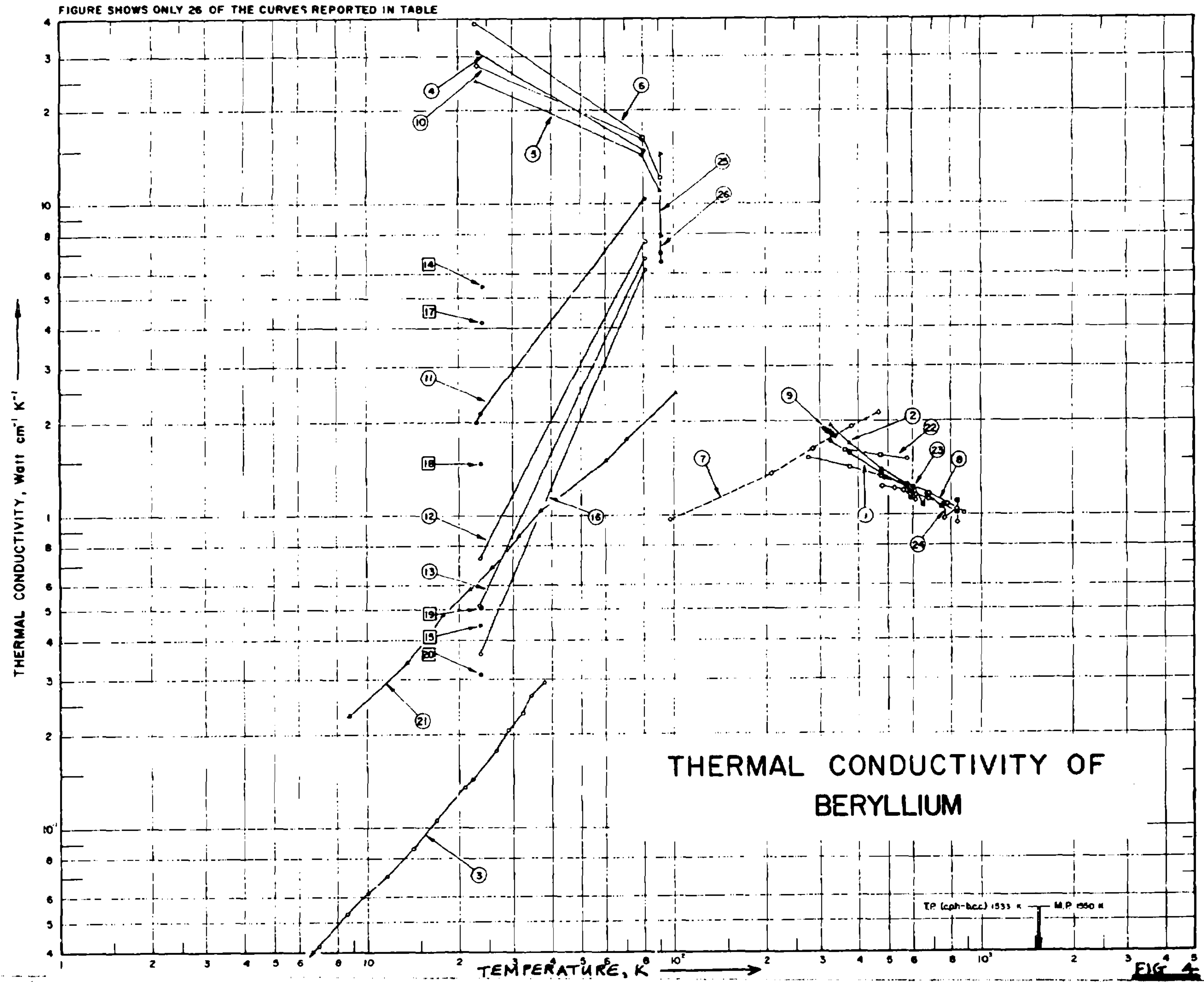


FIGURE SHOWS ONLY 26 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P. (cph-bcc) 1533 K
M.P. 1550 K
THERMAL CONDUCTIVITY OF BERYLLIUM

FIG. 4

SPECIFICATION TABLE NO. 4 THERMAL CONDUCTIVITY OF BERYLLIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 4]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	111	C	1953	323-673		Vi-A.R.	Specimen 1 x 1 x 6.6 cm; spectral analysis showed Mg, Ca, Ba, Si, Fe, Cu, Ti, Al and Mn as impurities; prepared from a block of beryllium by American G.E.C.; sintered; density 1.83 g cm^{-3}; electrical resistivity reported as 5.2, 6.2, 7.7, 10.9, 14.5, 18.2, 22.2, 26.4, and 30.8 µohm cm at 20, 50, 100, 200, 300, 400, 500, 600, and 700 C, respectively.
2	111	C	1953	323-673		Vi-H.T.	The above specimen heat treated at 700 C; electrical resistivity reported as 4.1, 5.0, 6.6, 9.9, 13.5, 17.1, 20.9, 25.2 and 29.9 µohm cm at 20, 50, 100, 200, 300, 400, 500, 600, and 700 C, respectively.
3	122	L	1955	1.8-38	2-3	Be-1	Pure specimen; 2.01 cm long, 0.231 cm dia; made from beryllium powder supplied by Atomic Energy Research Establishment; compressed and sintered at 1100 C in vacuo for several hrs; electrical resistivity ratio $\rho(293K)/\rho(20K)$ = 352.
4	56	L	1940	23-81		Be-3	Single crystal; heat flow perpendicular to hexagonal axis; electrical resistivity reported as 0.0078, 0.0452, and 0.0755 µohm cm at 20.36, 78.00, and 90.17 K, respectively.
5	56	L	1940	23-91		Be-4	Single crystal; electrical resistivity reported as 0.0124, 0.0537, and 0.0868 µohm cm at 20.37, 77.83, and 90.29 K, respectively; heat flow perpendicular to hexagonal axis.
6	56	L	1940	23-91		Be-8	Single crystal; electrical resistivity reported as 0.0076, 0.0473, and 0.0770 µohm cm at 20.34, 77.95, and 89.80 K, respectively; heat flow perpendicular to hexagonal axis.
7	278	F	1929	97-464	3-6		Commercially pure specimen; traces of Al, Mg, Cr, Fe, Si, and Mg; ~0.5 total impurities; 21 cm long, 1 cm in dia; supplied by Beryllium Co. of America; electrical resistivity reported as 1.50, 6.45, 14.64, 22.45, 32.45, and 39.00 µohm cm at 84, 294, 496, 674, 880, and 973 K, respectively.
8	753		1959	319.2			Vacuum cast.
9	235	L	1944	307-338			Pure; 2.553 cm long, 5.047 cm^2 cross-sectional area.
10	436	L	1938	23, 80		Be 2	Single crystal; hexagonal parallelepiped; supplied by Degussa Co.; length 1.6 cm; hexagonal cross section 0.00648 cm^2; electrical resistivity reported as 0.00458, 0.00454, and 3.58 µohm cm at 20.33, 79.02, and 273.15 K, respectively; density 1.84 g cm^{-3}; heat flow parallel to the hexagonal axis.
11	436	L	1938	23-81		Be 2	The above specimen measured at H (the transverse magnetic field strength) = 4490 oersteds and at θ (angle of rotation of the magnetic field in a plane perpendicular to the specimen axis) = -6°; H perpendicular to one of the binary lateral axes.
12	436	L	1938	23, 81		Be 2	The above specimen measured at H = 8750 oersteds and at θ = -6°.
13	436	L	1938	23, 81		Be 2	The above specimen measured at H = 10880 oersteds and at θ = -6°.
14	436	L	1938	23, 70		Be 2	The above specimen measured at H = 2280 oersteds and at θ = -6°.

SPECIFICATION TABLE NO. 4 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
15	436	L	1938	22.50		Be 2	The above specimen measured at H = 12200 oersteds and at $\theta = -6°$.
16	436	L	1938	23.81		Be 2	The above specimen measured at H = 10880 oersteds and at $\theta = +24°$ at which H is parallel to one of the binary lateral axes.
17	436	L	1938	23.70		Be 2	The above specimen measured at H = 2280 oersteds and at $\theta = +24°$.
18	436	L	1938	23.45		Be 2	The above specimen measured at H = 4490 oersteds and at $\theta = +24°$.
19	436	L	1938	23.40		Be 2	The above specimen measured at H = 8750 oersteds and at $\theta = +24°$.
20	436	L	1938	23.50		Be 2	The above specimen measured at H = 12200 oersteds and at $\theta = +24°$.
21	355	L	1955	9-102		Be 2	High purity, <0.1 Mg and trace of Fe; specimen 4 mm in dia; machined from a sintered rod of high purity beryllium; electrical resistivity at 295 K being 4.95 μohm cm; residual resistivity (extrapolated to 0 K) 1.20 μohm cm.
22	753		1959	363-573			Powder; sintered.
23	753		1959	499-840			Vacuum cast; extruded.
24	753		1959	476-840			Flake, extruded.
25	990	L	1942	92.1		Be 2	Single crystal; hexagonal parallelepiped; supplied by Degussa Co.; length 1.6 cm, hexagonal cross-section 0.00648 cm^2; electrical resistivity reported as 0.0450, 0.0763, and 3.58 μohm cm at 79.0, 90.2, and 273.2 K, respectively; density 1.84 g cm^{-3}; measured in magnetic field of strength 0 to 11.7 k Oe at θ (angle of rotation of magnetic field in a plane perpendicular to the specimen axis) = $-53°$ with the magnetic field perpendicular to one of the binary lateral axes.
26	990	L	1942	92.1		Be 2	The above specimen measured at $\theta = -23°$ and with the magnetic field parallel to one of the binary lateral axes.
27	56	L	1940	23.81		Be 3	Single crystal; electrical resistivity reported as 0.0835, 0.0789, and 0.1002 μohm cm at 20.36, 78.00, and 90.17 K, respectively; heat flow perpendicular to the hexagonal axis z; measured in a magnetic field of strength 3.4 kOe perpendicular to z.
28	56	L	1940	23.81		Be 3	The above specimen measured with the magnetic field of strength 3.4 kOe parallel to z; electrical resistivity reported as 0.1349, 0.0946, and 0.1114 μohm cm at 20.36, 78.00, and 90.17 K, respectively.
29	56	L	1940	80.6		Be 3	The above specimen measured in a magnetic field of strength 6.8 kOe perpendicular to z; electrical resistivity reported as 0.2037, 0.1465, and 0.1444 μohm cm at 20.36, 78.00, and 90.17 K, respectively.
30	56	L	1940	23.81		Be 3	The above specimen measured with the magnetic field of strength 6.8 kOe parallel to z; electrical resistivity reported as 0.3367, 0.1740, and 0.1756 μohm cm at 20.36, 78.00, and 90.17 K, respectively.

SPECIFICATION TABLE NO. 4 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
31	56	L	1940	23, 81		Be 3	The above specimen measured in a magnetic field of strength 10.1 kOe perpendicular to z; electrical resistivity reported as 0.4829, 0.2422, and 0.2074 μohm cm at 20.36, 78.00, and 90.17 K, respectively.
32	56	L	1940	23, 81		Be 3	The above specimen measured with the magnetic field of strength 10.1 kOe parallel to z; electrical resistivity reported as 0.6137, 0.2707, and 0.2533 μohm cm at 20.36, 78.00, and 90.17 K, respectively.
33	56	L	1940	23, 81		Be 3	The above specimen measured with the magnetic field of strength 11.7 kOe perpendicular to z; electrical resistivity reported as 0.6271, 0.2992, and 0.2435 μohm cm at 20.36, 78.00, and 90.17 K, respectively.
34	56	L	1940	23, 81		Be 3	The above specimen measured with the magnetic field of strength 11.7 kOe parallel to z; electrical resistivity reported as 0.7755, 0.3210, and 0.2968 μohm cm at 20.36, 78.00, and 90.17 K, respectively.
35	56	L	1940	79.0		Be 4	Single crystal; electrical resistivity reported as 0.0746, 0.0865, and 0.1114 μohm cm at 20.37, 77.83, and 90.29 K, respectively; heat flow perpendicular to z; measured in a magnetic field of strength 3.4 kOe perpendicular to z.
36	56	L	1940	79.0		Be 4	The above specimen measured with the magnetic field of strength 3.4 kOe parallel to z; electrical resistivity reported as 0.1226, 0.1038, and 0.1240 μohm cm at 20.37, 77.83, and 90.29 K, respectively.
37	56	L	1940	23, 79		Be 4	The above specimen measured in a magnetic field of strength 6.8 kOe perpendicular to z; electrical resistivity reported as 0.1989 and 0.1508 μohm cm at 20.37 and 77.83 K, respectively.
38	56	L	1940	23, 79		Be 4	The above specimen measured with the magnetic field of strength 6.8 kOe parallel to z; electrical resistivity reported as 0.2847 and 0.1886 μohm cm at 20.37 and 77.83 K, respectively.
39	56	L	1940	23-91		Be 4	The above specimen measured in a magnetic field of strength 10.1 kOe perpendicular to z; electrical resistivity reported as 0.3754, 0.2437, and 0.2184 μohm cm at 20.37, 77.83, and 90.29 K, respectively.
40	56	L	1940	23-91		Be 4	The above specimen measured with the magnetic field of strength 10.1 kOe parallel to z; electrical resistivity reported as 0.4939, 0.2934, and 0.2763 μohm cm at 20.37, 77.83, and 90.29 K, respectively.
41	56	L	1940	23-91		Be 4	The above specimen measured in a magnetic field of strength 11.7 kOe perpendicular to z; electrical resistivity reported as 0.480, 0.2972, and 0.2548 μohm cm at 20.37, 77.83, and 90.29 K, respectively.
42	56	L	1940	23-91		Be 4	The above specimen measured with the magnetic field of strength 11.7 kOe parallel to z; electrical resistivity reported as 0.612, 0.345, and 0.3228 μohm cm at 20.37, 77.83, and 90.29 K, respectively.

SPECIFICATION TABLE NO. 4 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
43	56	L	1940	23-91		Be 8	Single crystal; electrical resistivity reported as 0.0838 and 0.1028 μohm cm at 78.1 and 89.86 K, respectively; heat flow perpendicular to z; measured in a magnetic field of strength 3.4 kOe perpendicular to z.
44	56	L	1940	23-91		Be 8	The above specimen measured with the magnetic field of strength 3.4 kOe parallel to z; electrical resistivity reported as 0.0962 and 0.1119 μohm cm at 78.1 and 89.86 K, respectively.
45	56	L	1940	23-91		Be 8	The above specimen measured in a magnetic field of strength 6.8 kOe perpendicular to z; electrical resistivity reported as 0.1566 and 0.1507 μohm cm at 78.9 and 89.86 K, respectively.
46	56	L	1940	23-91		Be 8	The above specimen measured with the magnetic field of strength 6.8 kOe parallel to z; electrical resistivity reported as 0.1790 and 0.1767 μohm cm at 78.1 and 89.86 K, respectively.
47	56	L	1940	23-91		Be 8	The above specimen measured in a magnetic field of strength 10.1 kOe perpendicular to z; electrical resistivity reported as 0.2596 and 0.2187 μohm cm at 78.1 and 89.86 K, respectively.
48	56	L	1940	23-91		Be 8	The above specimen measured with the magnetic field of strength 10.1 kOe parallel to z; electrical resistivity reported as 0.2781 and 0.2572 μohm cm at 78.1 and 89.86 K, respectively.
49	56	L	1940	23-91		Be 8	The above specimen measured in a magnetic field of strength 11.7 kOe perpendicular to z; electrical resistivity reported as 0.3180 and 0.2582 μohm cm at 78.1 and 89.86 K, respectively.
50	56	L	1940	23-91		Be 8	The above specimen measured with the magnetic field of strength 11.7 kOe parallel to z; electrical resistivity reported as 0.3312 and 0.3002 μohm cm at 78.1 and 89.86 K, respectively.

DATA TABLE NO. 4 THERMAL CONDUCTIVITY OF BERYLLIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
323.2	1.730
373.2	1.570
473.2	1.360
573.2	1.230
673.2	1.130

CURVE 2

T	k
323.2	1.959
373.2	1.700
473.2	1.400
573.2	1.250
673.2	1.130

CURVE 3

T	k
1.75	0.008
2.80	0.015
3.40	0.018
4.40	0.025
5.40	0.032
6.91	0.042
8.56	0.053
10.00	0.062
11.60	0.070
14.13	0.086
16.81	0.106
20.73	0.135
21.96	0.144
26.40	0.178
28.87	0.206
32.06	0.234
34.33	0.266
37.84	0.294

CURVE 4

T	k
23.2	31.00
80.6	14.93

CURVE 5

T	k
22.7	25.30
79.0	14.68
90.6	11.04

CURVE 6

T	k
22.6	38.40
79.7	16.42
90.9	12.27

CURVE 7

T	k
97.0	0.971
208.2	1.360
282.6	1.644
378.4	1.912
463.6	2.125

CURVE 8

T	k
319.2	1.464

CURVE 9

T	k
307.1	1.887
313.1	1.874
314.3	1.853
316.1	1.862
319.8	1.858
320.9	1.854
326.9	1.828
327.8	1.828
328.4	1.812
333.3	1.791
338.1	1.791

CURVE 10

T	k
23.40	28.30
80.3	16.35

CURVE 11

T	k
22.74	2.00
23.45	2.14
80.7	10.40

CURVE 12

T	k
23.40	0.736
80.8	7.610

CURVE 13

T	k
23.40	0.517
80.9	6.720

CURVE 14

T	k
23.70	5.46

CURVE 15

T	k
23.50	9.445

CURVE 16

T	k
23.40	6.362
80.9	6.15

CURVE 17

T	k
23.70	4.17

CURVE 18

T	k
23.45	1.47

CURVE 19

T	k
23.40	0.510

CURVE 20

T	k
23.40	0.313

CURVE 21

T	k
8.72	0.228
13.5	0.340
17.7	0.480
21.7	0.582
25.7	0.685
31.2	0.856
36.7	1.04
60.0	1.50
70.0	1.75
101.5	2.45

CURVE 22

T	k
363.2	1.607
473.2	1.556
573.2	1.515

CURVE 23

T	k
494.2	1.226
555.2	1.276
591.2	[illegible]
594.2	1.192
601.2	[illegible]
650.2	[illegible]
673.2	1.176
746.2	1.067
766.2	1.092
837.2	1.021
840.2	1.113

CURVE 24

T	k
476.2	1.247
525.2	1.231
563.2	1.205
611.2	1.130
613.2	1.172
673.2	1.142
758.2	1.079
766.2	0.979
839.2	1.075
840.2	0.946

CURVE 25 (T = 92.1 K)

H(kOe)	k
0	14.61
10.1	7.87

CURVE 26 (T = 92.1 K)

H(kOe)	k
0	14.61
10.1	6.99
11.7	6.55

CURVE 27*

T	k
[illegible]	12.59
[illegible]	8.01

CURVE 28*

T	k
23.2	4.45
80.6	11.66

CURVE 29*

T	k
80.6	16.31

CURVE 30*

T	k
23.2	1.72
80.6	9.06

CURVE 31*

T	k
23.2	1.37
80.6	8.52

CURVE 32*

T	k
23.2	1.04
80.6	7.16

CURVE 33*

T	k
23.2	9.99
80.6	7.79

CURVE 34*

T	k
23.2	0.80
80.6	6.56

CURVE 35*

T	k
79.0	12.27

CURVE 36*

T	k
79.0	11.60

CURVE 37*

T	k
22.7	2.71
79.0	10.23

CURVE 38*

T	k
22.7	1.89
79.0	11.60

CURVE 39*

T	k
22.7	1.58
79.0	8.32
90.6	7.87

CURVE 40*

T	k
22.7	1.13
79.0	6.96
90.6	6.95

CURVE 41*

T	k
22.7	1.23
79.0	7.72
90.6	7.44

CURVE 42

T	k
22.7	0.90
79.0	6.12
90.6	6.45

CURVE 43*

T	k
22.6	6.14
79.7	13.72
90.9	10.80

CURVE 44*

T	k
22.6	4.36
79.7	13.02
90.9	10.59

CURVE 45*

T	k
22.6	2.26
79.7	11.0
90.9	9.44

CURVE 46*

T	k
22.6	1.84
79.7	9.71
90.9	8.91

CURVE 47*

T	k
22.6	1.16
79.7	9.21
90.9	8.36

CURVE 48*

T	k
22.6	1.05
79.7	7.66
90.9	7.62

CURVE 49*

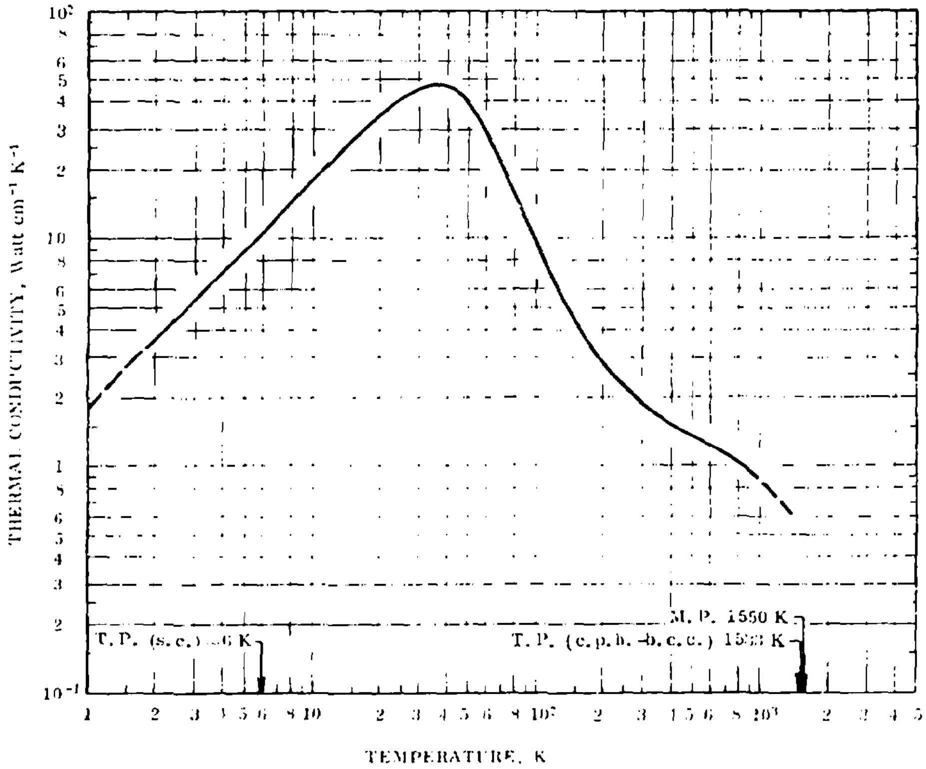
T	k
22.6	0.91
79.7	8.27
90.9	7.92

CURVE 50*

T	k
22.6	0.84
79.7	6.92
90.7	6.91

* Not shown on plot

FIGURE AND TABLE NO. 4R RECOMMENDED THERMAL CONDUCTIVITY OF BERYLLIUM



RECOMMENDED VALUES*

(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	1.39	70.3	440.3
1	(1.81)‡	(105)	-457.9	600	1.26	72.8	620.3
2	3.62	209	-456.1	700	1.15	66.4	800.3
3	5.42	313	-454.3	800	1.07	51.8	980.3
4	7.23	418	-452.5	900	(0.975)	(56.3)	1160
5	9.04	522	-450.7	1000	(0.887)	(51.3)	1340
6	10.8	624	-448.9	1100	(0.805)	(46.5)	1520
7	12.6	728	-447.1	1200	(0.734)	(42.4)	1700
8	14.4	832	-445.3	1300	(0.674)	(38.9)	1880
9	16.2	936	-443.5	1400	(0.622)	(35.9)	2060
10	18.0	1040	-441.7				
11	19.8	1140	-439.9				
12	21.6	1250	-438.1				
13	23.3	1350	-436.3				
14	25.1	1450	-434.5				
15	26.8	1550	-422.7				
16	28.4	1640	-430.9				
18	31.7	1830	-427.3				
20	34.8	2010	-423.7				
25	41.2	2380	-414.7				
30	45.6	2630	-405.7				
35	47.2	2730	-396.7				
40	46.2	2670	-387.7				
45	44.2	2550	-378.7				
50	40.0	2310	-369.7				
60	29.8	1720	-351.7				
70	21.7	2150	-333.7				
80	16.2	936	-315.7				
90	12.5	722	-297.7				
100	9.90	572	-279.7				
150	4.51	261	-189.7				
200	3.01	174	- 99.7				
250	2.36	136	- 9.7				
273.2	2.18	126	32.0				
300	2.00	116	80.3				
350	1.78	103	170.3				
400	1.61	93.0	260.3				

REMARKS

The recommended values are for well-annealed high-purity beryllium with residual electrical resistivity ρ_0 = 0.0135 $\mu\Omega$ cm (characterization by ρ_0 becomes *important below room temperature*). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.80, α' = 2.56 x 10^{-7}, and β = 0.553. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

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* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}. ‡ Values in parentheses are extrapolated.

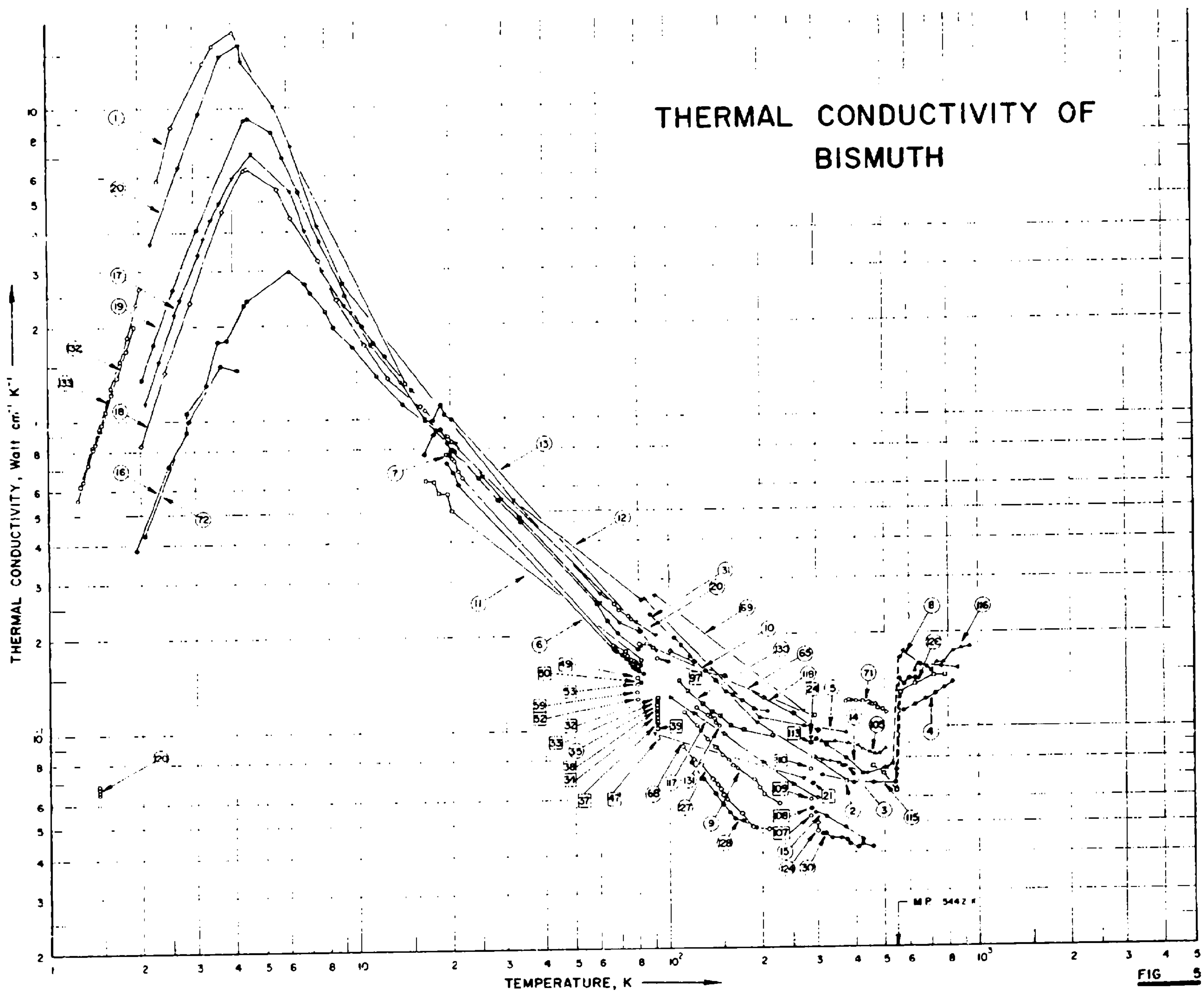

THERMAL CONDUCTIVITY OF
BISMUTH
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
MP 544.2 K

FIG 5

SPECIFICATION TABLE NO. 5 THERMAL CONDUCTIVITY OF BISMUTH

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 5]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	128	L	1944	2.3-76	1		Highly purified; single crystal; cylindrical specimen of 7.5 cm long and 0.1 cm^2 cross-sectional area; supplied by Hilger Co.; electrical resistivity ratio $\rho(T)/\rho(0C)$ = 0.320, 0.0725, 0.039 and 0.019 at 77, 35, 20.4, 14.1 and 4.2 K, respectively.
2	77	E	1900	291,373			Impurities, < 0.03 ~~each of Pb and Fe~~ (Fe + Pb); cast wire, 8.95 cm long, 1.795 cm dia; density 9.78 g cm^{-3} at 18 C; electrical conductivity at 18 and 100 C being 0.840 and 0.624 x 10^4 $ohm^{-1}cm^{-1}$, respectively.
3	126, 324	F	1955	293-373	5		Pure; cast from granular bismuth; electrical conductivity 7360, 6760, 6330, 5920, 5500 $ohm^{-1}cm^{-1}$ at 293, 313, 333, 353, and 373 K, respectively.
4	113	C	1957	573-623			High purity; molten metal; contained in a cavity 3.5 in. long, 0.94 in. dia; electrical resistivity 128.6, 131.1, 1[illegible].6, 136.0 and 138.5 μohm cm at 300, 350, 400, 450 and 500 C respectively; stainless steel used as comparative material.
5	49	L	1913	83-373			Pure; electrical conductivity reported as 2.640, 1.190, 0.915, and 0.612 x 10^4 $ohm^{-1}cm^{-1}$ at -190, -77, 0, and 100 C, respectively.
6	61	L	1936	19-83	5	PZ 2	99.997 Bi, 0.002 Ag, traces of Pb and Cu; single crystal; length 3 cm, cross-sectional area 0.1 cm^2; crystal grown from 'Bi 9506 bismuth' supplied by Adam Hilger Ltd., London; heat flow parallel to trigonal axis; electrical resistivity ratio $\rho(T)/\rho(0C)$ = 0.0711, 0.0634 and 0.0452 at 20.37, 18.47 and 14.15 K, respectively.
7	61	L	1936	19-81	5	PZ 4	99.998 Bi; 0.001 Ag; trace of Pb; single crystal; length 3 cm, cross-sectional area 0.1 cm^2; crystal grown from 'Bi 10283 bismuth' supplied by Adam Hilger Ltd., London, heat flow parallel to trigonal axis; $\rho(T)/\rho(0C)$ = 0.244, 0.0540, 0.0474, and 0.0324 at 70.85, 20.37, 18.47 and 14.15 K, respectively.
8	85	L	1919	362-857			Cylindrical specimen.
9	120	L	1934	112-228		No. 1	High purity; single crystal; specimen 1.231 cm in length and cross-section roughly triangular in shape with dimensions ~ 3 mm on a side; specimen prepared at California Institute of Technology; heat flow parallel to trigonal axis; measured in vacuum of 10^{-6} mm Hg.
10	120	L	1934	105-208		No. 2	High purity; single crystal; specimen 1.3 cm long and similar in form to No. 1; specimen prepared at California Institute of Technology; heat flow perpendicular to trigonal axis; measured in a vacuum of 10^{-6} mm Hg.
11	1008	L	1934	17-81		P	99.995 Bi; major impurity, Ag; single crystal; specimen consisted of two rods each of size 28 x 5 x 5 mm; grown from H.S. Brand, Laboratory No. 8016 bismuth, supplied by Adam Hilger Ltd., London; heat flow parallel to trigonal axis (the specimen axis).
12	60	L	1934	17-81		S_1	99.995 Bi; major impurity, Ag; single crystal; specimen consisted of two rods each of size 28 x 5.8 x 4.5 mm; grown from material supplied by Adam Hilger Ltd., London; material melted and pressed into mould to be in contact with a seed crystal, then cooled slowly to crystalize; heat flow parallel to a binary axis.

SPECIFICATION TABLE NO. 5 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
13	60	L	1934	17-81		S_2	Similar to the above specimen except heat flow parallel to a bisectrix between two binary axes.
14	277	L	1939	298-423		Bi-1	High purity; spectroscopic examination showing traces of Pb and Cu; single crystal; specimen cut in the form of disks 25 mm in dia and 2 mm thick from a large crystal grown by Bridgman's method; supplied by Kahlbaum; density 9.78 g cm^{-3} at room temp, electrical resistivity reported as 114 μohm cm at 25 C; heat flow perpendicular to trigonal axis. (Data extracted from smooth curve.)
15	277	L	1939	298-423		Bi-2	Similar to the above specimen except electrical resistivity 144 μ ohm cm at 25 C and heat flow parallel to trigonal axis.
16	424	L	1958	2-90	1	Bi-1	99.97 pure when received; specimen 2 mm dia, 6 cm long, it contained columnar crystals penetrating to the centre of the rod, 16 to 18 crystals being exposed on the circular section; metal supplied by Mining and Chemical Products (London); cast and cooled quickly; residual electrical resistivity ρ_0 = 104 μohm cm; ρ(295K) = 136 μ ohm cm.
17	424	L	1958	2-91	1	Bi-2	99.99 pure; 6 columnar crystals per circular section; specimen 3 mm dia, 6 cm long; granular bismuth supplied by the General Chemical Division of Allied Chemical and Dye Corp.; cast in a brass former, cooled slowly; residual electrical resistivity ρ_0 = 5.9 μ ohm cm; ρ(295 K) = 120 μ ohm cm.
18	424	L	1958	2-78	1	Bi-3	99.999 pure; crystals about 1 cm long and had the lateral dimensions of the rod; specimen about 3.5 mm dia, 6 cm long; bismuth supplied by Varlacoid Chemical Co. of New York, zone-refined and annealed for several days at a temp just below melting point; residual electrical resistivity ρ_0 = 2.07 μohm cm; ρ(295 K, assumed) = 118 μ ohm cm.
19	424	L	1958	2-79	1	Bi-4	99.999 pure; specimen contained about 3 crystals; it had a triangular cross-section of sides 5, 5, and 2.5 mm, 6 cm long, cut from zone-refined bar; supplied by Varlacoid Chemical Co.; residual electrical resistivity ρ_0 = 1.70 μohm cm; ρ(295 K, assumed) = 118 μ ohm cm.
20	424	L	1958	2-91	1	Bi-5	Cut from the same bar as the above specimen; contained crystals 2 to 4 mm wide and 1 to 2 cm long; square cross-section 6 x 6 mm; residual electrical resistivity ρ_0 = 2.4 μohm cm; ρ(295 K, assumed) = 118 μ ohm cm.
21	469	L	1923	219			0.02 Pb, trace of Fe; single crystal; 1.842 x 1.023 x 0.168 cm; annealed; heat flow parallel to trigonal axis.
22	469	L	1923	219			Similar to above specimen except dimensions 1.843 x 1.022 x 0.167 cm and heat flow perpendicular to trigonal axis.
23	470	L	1949	287.2		1	Pure single crystal; 0.9114 cm cubic specimen; bismuth supplied by Merch; heat flow parallel to trigonal axis.
24	470	L	1949	287.2		1	The above specimen; heat flow perpendicular to the trigonal axis.

SPECIFICATION TABLE NO. 5 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
25	470	L	1949	287.2		2	Similar to the above specimen except heat flow parallel to the trigonal axis.
26	470	L	1949	287.2		2	The above specimen; heat flow perpendicular to the trigonal axis.
27	470	L	1949	287.2		3	Pure, polycrystalline; cubic specimen 0.93 x 0.93 x 0.93 cm; bismuth supplied by Merck.
28	470	L	1949	287.2		4	Similar to the above specimen.
29	230	L	1925	328.2			Total impurities < 0.03; specimen 10 cm long, 1.9 cm in dia; bismuth from Baker's Analyzed Metal; electrical conductivity 0.84 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
30	248	E	1956	313-453	3		99.997 pure.
31	471	L	1903	87-291			Pure; density 9.67, 10.04 and 10.44 g cm^{-3} at 18, -79, and -186 C, respectively; electrical conductivity 0.861, 1.196 and 2.452 x 10^4 $ohm^{-1}cm^{-1}$ at 18, -79, and -186 C, respectively. (Note: the paper gives electrical conductivity as 10^5 ohm^{-1} cm^{-1} which is probably an error)
32	472	L	1937	91.5		Bi 66	Pure; single crystal; the angle between rod axis and trigonal axis $\Phi = 2^\circ$.
33	472	L	1937	91.5		Bi 66	The above specimen measured in a magnetic field approximately parallel to the z-axis and the xz-plane (z-axis coincident with the trigonal axis; x-axis parallel to a diagonal, which does not intersect with the trigonal axis of one face of the crystal i.e., parallel to a two-fold secondary axis, with strength H=650 oersteds.
34	472	L	1937	91.6		Bi 66	The above specimen measured at H=650 oersteds approximately parallel to x-axis.
35	472	L	1937	91.4-91.5		Bi 66	The above specimen measured at H=1500 oersteds (H in xz-plane) and at ψ (angle between H and z-axis) ranging from 0 to -10°.
36	472	L	1937	91.5		Bi 66	The above specimen measured at H=2520 oersteds (H parallel to xz-plane) and at $\psi = 0^\circ$.
37	472	L	1937	91.7		Bi 66	The above specimen measured at H=2520 oersteds (H parallel to xz-plane) and at $\psi = 90^\circ$.
38	472	L	1937	91.6		Bi 66	The above specimen measured at H=4850 oersteds (H parallel to xz-plane) and at $\psi = 0^\circ$.
39	472	L	1937	91.7		Bi 66	The above specimen measured at H=4850 oersteds (H parallel to xz-plane) and at ψ = [illegible].
40	472	L	1937	91.5-91.7		Bi 66	The above specimen measured at H=6100 oersteds (H parallel to xz-plane) and at ψ ranging from 0 to -20°.
41	472	L	1937	91.5		Bi 66	The above specimen measured without magnetic field.
42	472	L	1937	91.6		Bi 66	The above specimen measured in a magnetic field parallel to the yz-plane with H=650 oersteds and $\psi = 10^\circ$ (H approximately parallel to the trigonal axis).
43	472	L	1937	91.8		Bi 66	The above specimen measured at H=650 oersteds (H parallel to yz-plane) and at $\psi = 100^\circ$ (H approximately parallel to y-axis).

SPECIFICATION TABLE NO. 5 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
44	472	L	1937	91.7-92.0		Bi 66	The above specimen measured at H 1500 oersteds (H parallel to yz-plane) and at ψ ranging from 10 to -80°.
45	472	L	1937	91.37-91.40		Bi 66	The above specimen measured at H 2520 oersteds (H parallel to yz-plane) and at ψ ranging from 10 to 100°.
46	472	L	1937	91.8		Bi 66	The above specimen measured at H 4850 oersteds (H parallel to yz-plane) and at ψ = 10°.
47	472	L	1937	92.0		Bi 66	The above specimen measured at H 4850 oersteds (H parallel to yz-plane) and at ψ = 100°.
48	472	L	1937	91.8-92.0		Bi 66	The above specimen measured at H 6100 oersteds (H parallel to yz-plane) and at ψ ranging from 10 to -20°.
49	472	L	1937	79.2		Bi 66	The above specimen measured without magnetic field.
50	472	L	1937	80.8		Bi 66	The above specimen measured without magnetic field.
51	472	L	1937	79.2		Bi 66	The above specimen measured at H 650 oersteds (H parallel to yz-plane) and at ψ = 10°.
52	472	L	1937	79.3		Bi 66	The above specimen measured at H 650 oersteds (H parallel to yz-plane) and at ψ = 100°.
53	472	L	1937	79.1		Bi 66	The above specimen measured at H 1500 oersteds (H parallel to yz-plane) and at ψ = 10°.
54	472	L	1937	79.4		Bi 66	The above specimen measured at H 1500 oersteds (H parallel to yz-plane) and at ψ = 100°.
55	472	L	1937	79.3		Bi 66	The above specimen measured at H 2520 oersteds (H parallel to yz-plane) and at ψ = 10°.
56	472	L	1937	79.4		Bi 66	The above specimen measured at H 2520 oersteds (H parallel to yz-plane) and at ψ = 100°.
57	472	L	1937	79.4		Bi 66	The above specimen measured at H 4850 oersteds (H parallel to yz-plane) and at ψ = 10°.
58	472	L	1937	79.4		Bi 66	The above specimen measured at H 4850 oersteds (H parallel to yz-plane) and at ψ = 100°.
59	472	L	1937	79.2		Bi 66	The above specimen measured at H 6100 oersteds (H parallel to yz-plane) and at ψ = 10°.
60	472	L	1937	79.4		Bi 66	The above specimen measured at H 6100 oersteds (H parallel to yz-plane) and at ψ = 100°.
61	472	L	1937	79.4		Bi 66	The above specimen measured at H 6100 oersteds (H parallel to yz-plane) and at ψ = -80°.
62	472	L	1937	91.2		Bi 51	Pure, single crystal; the angle between rod axis and trigonal axis Φ = 86°.
63	472	L	1937	91.2-91.5		Bi 51	The above specimen measured in a magnetic field parallel to the plane containing the trigonal axis (z-axis) and the rod axis with strength H 2520 oersteds and at ψ' (angle between field direction and a line such that at ψ' = 7°, H perpendicular z-axis and at ψ' = 97°, H parallel z-axis) ranging from 8 to -10°.
64	472	L	1937	91.6-91.8		Bi 51	The above specimen measured at H 6100 oersteds (H parallel to the plane containing z-axis and the rod axis) and at ψ' ranging from 7 to -5°.
65	473	L	1934	80-297		Bi 9	Single crystal; 0.55 cm dia x 3.6 cm long; the angle between rod axis and trigonal axis about 80°; electrical resistivity reported as 46.95, 48.32, 49.41, 103.6 and 112.2 μ ohm cm at -193.92, -188.19, -183.62, 0, and 21.02 C, respectively.

SPECIFICATION TABLE NO. 5 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
66	473	L	1934	81.1		Bi 9	The above specimen measured in a transverse magnetic field (H perpendicular to rod axis) with H (field strength) - 5900 gauss and at θ (the angle between field and rod axis) ranging from 25 to 170°; electrical resistivity at -194.5 C reported as 601, 620, and 458 μ ohm cm at θ = 25, 35, and 170°, respectively.
67	473	L	1934	89.4-90.5		Bi 9	The above specimen measured in a transverse magnetic field; H 5900 gauss and θ ranging from 35 to 170°; electrical resistivity at -183.5 C reported as 510, 408, and 391 μ ohm cm at θ = 35, 95 and 170°, respectively.
68	425	L	1924	90,273	5		Polycrystal with fine grains; electrical conductivity 2.61 and 9.29 x 10^3 $ohm^{-1}cm^{-1}$ at 90 and 273 K respectively. (Note the paper gives 10^4, probably a typographical error.)
69	425	L	1924	90,273	5		Polycrystal with coarse grains; electrical conductivity 2.55 and 8.98 x 10^3 $ohm^{-1}cm^{-1}$ at 90 and 273 K respectively. (Note the paper gives 10^4, probably a typographical error.)
70	368		1954	298.2			Fine-crystalline extruded specimen; concentration of current carriers 8.8 x 10^{18} cm^{-3}; electrical conductivity 6760 $ohm^{-1}cm^{-1}$ at 25 C.
71	431	E	1944	372-501			Pure; polycrystal; electrical resistivity 179.20 to 277.00 μohm cm at 372.3 to 501.1 K.
72	754	L	1963	2.1-4.1			Very pure, single crystal; prepared from spectroscopically pure bismuth; light parallepiped 24.3 x 6.9 x 2.5 mm; obtained from Johnson Matthey and Co.; crystal resistance ratio R(300 K)/R(4.2 K) = 40.
73	474	L	1950	82-90		Bi-S_4	Single crystal; rod axis perpendicular to the trigonal axis and approximately parallel to one of the two-fold secondary axes (one side of the base triangle); electrical resistivity reported as 39.93 and 99.4 μohm cm at -187.5 and 0 C, respectively.
74	474	L	1950	83-89		Bi-S_7	Single crystal; rod axis perpendicular to trigonal axis and perpendicular to one of the two-fold secondary axes (one side of the base triangle); electrical resistivity reported as 40.18 and 100.7 μohm cm at -187.5 and 0 C, respectively.
75	475	L	1936	78,90		Bi 66	Pure; single crystal; the angle between trigonal axis and rod axis ϕ = 2°; 3 mm dia x 4 ~ 5 cm long; electrical resistivity reported as 36.1, 41.0 and 127.4 μ ohm cm at -195.39, -182.98 and 0 C, respectively.
76	475	L	1936	78,90		Bi 13	Pure; single crystal; ϕ = 16°; 3 mm dia x 4 ~ 5 cm long; electrical resistivity reported as 37.4, 42.0, 86.6 and 125.6 μ ohm cm at -194.84, -183.20, -78.36 and 0 C, respectively.
77	475	L	1936	78,90		Bi 51	Pure; single crystal; ϕ = 86 [illegible] mm dia x 4 ~ 5 cm long; electrical resistivity reported as 37.0, 40.4 and 99.1 μ ohm cm at -194.78, -183.49 and 0 C, respectively.
78	475	L	1936	90.0		Bi 72	Pure; single crystal; ϕ = 85.5°; 3 mm dia x 4 ~ 5 cm long; electrical resistivity reported as 43.0 and 102.9 μ ohm cm at -183.13 and 0 C, respectively.
79	475	L	1936	91.8		Bi 66	Pure; single crystal; ϕ = 2°; 0.0898 cm^2 x 2.23 cm long.

SPECIFICATION TABLE NO. 5 *(continued)*

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
80	475	L	1936	92.2		Bi 66	The above specimen measured in a transverse magnetic field (H perpendicular to rod axis) with strength H=2520 oersteds and field orientation θ (the angle between field direction and a line perpendicular to the rod axis such that at θ = -12°, H is parallel to the x-axis and at θ = 78°, H is parallel to the y-axis; θ = -161°; x-axis parallel to one of the two-fold secondary axes; z-axis coincided with the trigonal axis.
81	475	L	1936	79.6		Bi 66	The above specimen measured without magnetic field.
82	475	L	1936	79.8		Bi 66	The above specimen measured at H=1500 oersteds and at θ = 108°.
83	475	L	1936	79.9		Bi 66	The above specimen measured at H=2520 oersteds and at θ = -41°.
84	475	L	1936	79.9		Bi 66	The above specimen measured at H=4850 oersteds and at mean θ (averaged from values which varied from 15-30°).
85	475	L	1936	79.9		Bi 66	The above specimen measured at H=6100 oersteds and at mean θ.
86	475	L	1936	91.0		Bi 13	Pure; single crystal; the angle between trigonal axis and rod axis φ = 16°; 0.1452 cm² x 3.10 cm long.
87	475	L	1936	91.2		Bi 13	The above specimen measured in a transverse magnetic field (H perpendicular to rod axis) with strength H=2460 oersteds and field orientation at θ = 4 and 78°, where θ is the angle between field direction and a line perpendicular to the rod axis such that at θ = 6°; H approx. parallel to x-axis.
88	475	L	1936	79,91		Bi 13	The above specimen measured at H=6100 oersteds and at mean θ (averaged from values which varied from 15-30°).
89	475	L	1936	78.5		Bi 13	The above specimen measured without magnetic field.
90	475	L	1936	78.7		Bi 13	The above specimen measured at H=2460 oersteds and at θ = -4 and 38°.
91	475	L	1936	78.7		Bi 13	The above specimen measured at H=6100 oersteds and at θ = 38°.
92	475	L	1936	79,91		Bi 51	Pure; single crystal; the angle between trigonal axis and rod axis φ = 86°; 0.0749 cm² x 2.18 cm long.
93	475	L	1936	91.1		Bi 51	The above specimen measured in a transverse magnetic field (H perpendicular to rod axis) with strength H=2520 oersteds and field orientation at θ = -152°; where θ is the angle between field direction and a line perpendicular to the rod axis such that at θ = 35°; H parallel to negative x-axis and at θ = -55°; H parallel to z-axis.
94	475	L	1936	91.4		Bi 51	The above specimen measured at H=4900 oersteds and at θ = -152°.
95	475	L	1936	79.3		Bi 51	The above specimen measured at H=2520 oersteds and at mean θ (averaged from values which varied from 15-30°).

SPECIFICATION TABLE NO. 5 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
96	475	L	1936	91.3		Bi 72	Pure; single crystal; the angle between trigonal axis and rod axis $\phi = 85.5^\circ$; 0.0907 cm^2 x 2.51 cm long.
97	475	L	1936	91.3		Bi 72	The above specimen measured in a transverse magnetic field (H perpendicular to rod axis) with strength H=650 oersteds and field orientation at $\theta = 2^\circ$, where θ is the angle between field direction and a line perpendicular to the rod axis such that at $\theta = 8^\circ$, H is parallel to negative z-axis and at $\theta = 98^\circ$, H is perpendicular to z-axis.
98	475	L	1936	91.3		Bi 72	The above specimen measured at H=650 oersteds and at $\theta = -124^\circ$.
99	475	L	1936	91.2-91.4		Bi 72	The above specimen measured at H=1500 oersteds and at θ ranging from 2 to -34°.
100	475	L	1936	91.2		Bi 72	The above specimen measured at H=2520 oersteds and at $\theta = 2^\circ$.
101	475	L	1936	91.3		Bi 72	The above specimen measured at H=2520 oersteds and at $\theta = -124^\circ$.
102	475	L	1936	91.6		Bi 72	The above specimen measured at H=4900 oersteds and at $\theta = 2^\circ$.
103	475	L	1936	91.6		Bi 72	The above specimen measured at H=4900 oersteds and at $\theta = -124^\circ$.
104	475	L	1936	91.3-91.5		Bi 72	The above specimen measured at H=6100 oersteds and at θ ranging from 2 to -34°.
105	383		1956	320-500			Pure; electrical conductivity reported as 0.744, 0.684, 0.602, 0.544, 0.516, 0.509, 0.477, 0.446, 0.421 and 0.380 x 10^4 $ohm^{-1}cm^{-1}$ at 46.7, 69.1, 105.8, 134.6, 148.7, 152.1, 169.0, 188.8, 203.8 and 227.0 C, respectively.
106	460		1957	373.2			Pure.
107	470	L	1949	287.2			Pure; single crystal; bismuth plate, 2 x 9.3 x 9.3 mm; supplied by Merck; θ (the angle between the trigonal axis of the crystal and the direction of heat flow) = 0°.
108	470	L	1949	287.2			Similar to the above specimen except $\theta = 14.7^\circ$.
109	470	L	1949	287.2			Similar to the above specimen except $\theta = 27.2^\circ$.
110	470	L	1949	287.2			Similar to the above specimen except $\theta = 50.7^\circ$.
111	470	L	1949	287.2			Similar to the above specimen except $\theta = 67.9^\circ$.
112	470	L	1949	287.2			Similar to the above specimen except $\theta = 74.3^\circ$.
113	470	L	1949	287.2			Similar to the above specimen except $\theta = 89.0^\circ$.
114	577	L	1913	83-373			Pure; cylindrical specimen; made from bismuth supplied by C.A.F. Kahlbaum; bismuth powder pressed at 5000 kg cm^{-2} for 1 hour; density 1% less than cast bismuth; electrical conductivity reported as 3.5, 3.8, and 3.2 x 10^3 $ohm^{-1}cm^{-1}$ at -190, 0, and 100 C, respectively.
115	597, 708	L	1961	313-630	5		Measurements made on solid specimen and molten specimen (from same source as the solid specimen); 3 mm in diameter, 64 mm long used to determine data in liquid state; melting point 544.2 K.

SPECIFICATION TABLE NO. 5 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
116	592	L	1959	626-945			In liquid state; melting point 271°.
117	755	L	1962	100-300	~6		99.999 pure; single crystal; specimen 2 x 2 x 10 mm; provided by American Smelting and Refining Co.; as received; electrical resistivity 34.2, 42.4, 85.3 and 134.8 μohm cm at 79, 100, 200 and 300 K, respectively; heat flow parallel to trigonal axis.
118	755	L	1962	100-300	~6		Similar to the above specimen except electrical resistivity 32.5, 39.0, 73.1 and 111.7 μohm cm at 81, 100, 200 and 300 K, respectively; heat flow perpendicular to trigonal axis.
119	706	L	1881	273,373			Density 9.74 g cm^{-3}; electrical conductivity 0.929 and 0.630 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C respectively. (electrical conductivity reported as 0.929 and 0.63 x 10^5 ohm^{-1} cm^{-1}, probably a typographical error)
120	331	L	1964	1.46			Single crystal with rhombohedral structure; 16.8 x 4.55 x 2.0 mm, with trigonal axis parallel to the small dimension and bisectrix parallel to the large dimension; specimen taken from cylindrical ingot supplied by Texas Instruments Corporation; electrical resistivity reported as 1.1 and 1.2 μohm cm at 1.12 and 4.2 K, respectively; $\rho_{298.2}/\rho_{4.2}$ reported as 91.2; measured with the magnetic field directed along the trigonal axis, and the heat flow along the large dimension; magnetic field ranging from 1.02 to 17.98 kilogauss.
121	333	L	1929	300.2	±.50		Single crystal; disk specimen 25 mm in diameter and 2 mm thick; heat flow perpendicular to the trigonal axis; measured in magnetic fields (H) ranging from 2499 to 10554 gauss perpendicular to the trigonal axis.
122	333	L	1929	300.2	±.50		Similar to the above specimen except measured in magnetic fields parallel to the trigonal axis ranging from 0 to 10773 gauss.
123	333	L	1929	300.2	±.50		Single crystal; disk specimen 25 mm in dia and 2.0 mm thick; heat flow parallel to the trigonal axis; measured in magnetic fields perpendicular to the trigonal axis ranging from 0 to 11161 gauss.
124	333	L	1929	300.2	±.50		Similar to the above specimen except disk 2.02 mm thick and measured in magnetic fields ranging from 5071 to 9847 gauss.
125	333	L	1929	300.2	±.50		The above two specimens combined together (4.02 mm thick); measured in the same conditions as above with magnetic fields ranging from 4997 to 9973 gauss.
126	838	C	1967	453-770			The molten specimen placed in a hole 21 mm in dia drilled in an asbestos cement cylinder of 30 mm height; steel 1Kh18N9T used as comparative material.
127	120, 323	L	1934	110-209		1	Single crystal; specimen length 1.231 cm cross-section roughly triangular in shape with dimensions about 3 mm on a side; trigonal axis parallel to the length; supplied by Prof A. Goetz of CIT; measured in a vacuum of 10^{-6} mm Hg, and in a magnetic field of 7800 gauss parallel to one of the binary axes; heat flow along the trigonal axis.

SPECIFICATION TABLE NO. 5 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
128	120, 323	L	1934	117-190		1	The above specimen measured with the magnetic field perpendicular to one of the binary axes.
129	120, 323	L	1934	114-198		2	Single crystal; specimen length 1.3 cm. cross-section roughly triangular in shape with dimensions about 3 mm on a side; trigonal axis perpendicular to the length; measured in a vacuum of 10^{-6} mm Hg and in a magnetic field of 7800 gauss perpendicular to the trigonal axis; heat flow perpendicular to the trigonal axis.
130	120, 323	L	1934	108-216		2	The above specimen measured with the magnetic field parallel to the trigonal axis.
131	120, 323	L	1934	122-145		2	The above specimen measured with the magnetic field at 45° to the trigonal axis.
132	872	-	1967	1.3-1.9		Sample 3	99.9999 pure; single crystal; specimen 1.57 x 3.1 mm in cross-section; specimen axis along the bisectrix; electrical resistivity ratio $\rho(300)/\rho(4.2)$ - 140; thermal conductivity values calculated from heat capacity, velocity and effective mean free path.
133	872	-	1967	1.3-2.0		Sample 5	99.9999 pure; single crystal; specimen 3.8 x 3.85 mm in cross-section; specimen axis along the trigonal; electrical resistivity ratio $\rho(300)/\rho(4.2)$ - 104; thermal conductivity values calculated from heat capacity, velocity and effect mean free path.
134	1002	L	1967	80-301			Single crystal; 0.4 x 0.2 x 0.2 in.; electrical resistivity reported as 0.0349, 0.0472, 0.0680, 0.0854, 0.113, and 0.134 milliohm cm at 80, 112, 160, 198, 253, and 299 K, respectively; heat flow along the trigonal axis.
135	1002	L	1967	81-303			Single crystal; 0.4 x 0.2 x 0.2 in.; electrical resistivity reported as 0.0324, 0.0445, 0.0602, 0.0727 0.0950 and 0.116 milliohm cm at 77, 115, 156, 193, 249 and 298 K, respectively; heat flow along one of the binary axis.

DATA TABLE NO. 5 THERMAL CONDUCTIVITY OF BISMUTH

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
2.30	5.847
2.55	8.771
3.25	14.010
3.47	15.924
4.05	17.513
14.35	1.299
16.68	1.064
19.57	0.877
20.16	0.840
66.80	0.251
69.00	0.240
74.00	0.230
75.50	0.225
CURVE 2	
291.2	0.0810
373.2	0.0674
CURVE 3	
293.2	0.081
313.2	0.079
333.2	0.078
353.2	0.077
373.2	0.075
CURVE 4	
573.0	0.113
623.0	0.118
673.0	0.123
723.0	0.128
773.0	0.134
823.0	0.139
CURVE 5	
83.2	0.261
196.2	0.108
273.2	0.102
373.2	0.0967
CURVE 6	
19.47	0.719
20.44	0.671
21.13	0.613
66.71	0.181
67.70	0.179
67.90	0.178
70.63	0.174
73.17	0.168
75.21	0.164
76.87	0.159
78.35	0.157
79.67	0.156
80.44	0.154
83.07	0.152
CURVE 7	
19.38	0.769
19.70	0.763
19.91	0.757
20.22	0.741
20.57	0.730
21.23	0.675
21.93	0.645
66.35	0.186
67.02	0.185
72.83	0.178
73.83	0.172
75.68	0.167
77.08	0.166
77.55	0.165
78.70	0.163
79.54	0.159
80.30	0.169
81.31	0.160
CURVE 8	
362.2	0.0757
433.2	0.0711
495.2	0.0741
506.2	0.0741
CURVE 8 (cont.)	
529.2	0.0766
559.2	0.167
571.2	0.175
649.2	0.158
757.2	0.156
857.2	0.154
CURVE 9	
112.3	0.1130
123.6	0.1030
133.3	0.0933
141.0	0.0879
142.6	0.0874
149.8	0.0828
155.9	0.0799
160.4	0.0766
166.5	0.0749
188.0	0.0686
195.8	0.0649
202.5	0.0619
227.5	0.0577
CURVE 10	
104.7	0.196
109.7	0.186
117.1	0.171
131.8	0.154
141.5	0.144
152.5	0.132
160.0	0.129
172.6	0.123
188.8	0.116
208.4	0.114
CURVE 11	
16.54	0.631
17.63	0.625
18.33	0.577
19.53	0.572
CURVE 11 (cont.)	
20.01	0.507
81.44	0.166
CURVE 12	
16.50	0.770
17.53	0.891
18.53	0.921
19.53	0.837
20.04	0.747
81.47	0.259
CURVE 13	
16.51	0.987
17.52	0.987
18.52	1.109
19.03	1.038
20.04	0.996
81.48	0.206
CURVE 14	
298.2	0.0925
323.2	0.0883
373.2	0.0800
423.2	0.0710
CURVE 15	
298.2	0.0540
323.2	0.0523
373.2	0.0481
423.2	0.0439
CURVE 16	
1.93	0.385
2.46	0.718
2.81	0.924
2.83	1.07
3.27	1.30
CURVE 16 (cont.)	
3.58	1.79
3.81	1.80
4.33	2.33
4.45	2.41
6.08	2.98
6.80	2.72
7.09	2.55
7.95	2.22
8.40	1.97
9.70	1.70
11.55	1.37
14.02	1.12
17.9	0.918
20.6	0.784
24.6	0.644
28.4	0.544
33.6	0.465
59.1	0.253
63.6	0.222
68.6	0.204
79.6	0.180
CURVE 17	
2.07	1.14
2.29	1.54
2.59	2.17
2.69	2.42
3.10	3.35
3.22	3.77
3.40	4.37
3.64	4.94
4.01	5.95
4.59	7.15
5.18	5.34
6.86	4.00
7.78	2.96
9.09	2.31
9.59	2.18
11.17	1.72
13.8	1.31
17.5	0.996
CURVE 17 (cont.)	
20.7	0.830
25.4	0.650
28.9	0.550
33.3	0.480
59.5	0.252
69.4	0.220
80.0	0.206
91.0	0.179
CURVE 18	
1.99	0.83
2.41	1.43
2.91	2.39
3.69	4.69
4.34	6.30
4.46	6.36
5.55	5.45
6.15	4.43
7.52	3.22
8.61	2.40
10.57	1.73
12.70	1.35
15.99	1.10
64.2	0.237*
78.2	0.200*
CURVE 19	
2.01	1.36
2.21	1.77
2.57	2.63
3.05	4.10
4.36	9.09
4.48	9.29
5.33	8.37
5.84	6.92
6.52	5.36
7.60	3.72
9.14	2.49
10.4	1.98
11.36	1.76
CURVE 19 (cont.)	
12.3	1.58
15.0	1.24
19.4	0.91
24.3	0.71
32.6	0.49
78.5	0.22
CURVE 20	
2.17	3.66
2.69	6.47
3.12	9.60
3.66	14.60
4.22	15.9
4.32	14.0
5.47	10.0
6.16	7.38
7.49	4.18
9.06	2.70
31.9	0.545
60.0	0.274
78.6	0.22
90.7	0.20
CURVE 21	
291.2	0.0665
CURVE 22*	
291.2	0.0925
CURVE 23*	
287.2	0.0529
CURVE 24	
287.2	0.0935

*Not shown on plot

DATA TABLE NO. 5 (continued)

T	k
CURVE 25*	
287.2	0.0533
CURVE 26*	
287.2	0.0950
CURVE 27*	
287.2	0.0794
CURVE 28*	
287.2	0.0808
CURVE 29*	
328.2	0.0795
CURVE 30	
313.2	0.0460
321.2	0.0460
335.2	0.0444
358.2	0.0444
375.2	0.0439
383.2	0.0427
409.2	0.0418
421.2	0.0427
453.2	0.0418
CURVE 31	
87.2	0.233
194.2	0.105
291.2	0.0803*
CURVE 32	
91.47	0.1264
CURVE 33	
91.49	0.1238

T	k
CURVE 34	
91.59	0.1146
Ψ (deg)	k
CURVE 35 (T = 91.36-91.50 K)	
0	0.1217
20	0.1170
60	0.1084
90	0.1076
120	0.1085*
150	0.1127*
180	0.1217*
-160	0.1171*
-120	0.1085*
- 90	0.1082*
- 10	0.1186*
T	k
CURVE 36*	
91.53	0.1186
CURVE 37	
91.65	0.1045
CURVE 38	
91.60	0.1147
CURVE 39	
91.68	0.1002
Ψ (deg)	k
CURVE 40* (T = 91.45-91.65 K)	
0	0.1138
20	0.1071
50	0.1011

Ψ (deg)	k
CURVE 40 (cont.)*	
90	0.0992
120	0.1009
140	0.1011
160	0.1067
180	0.1154
-160	0.1087
-130	0.1036
- 90	0.1009
- 60	0.1018
- 40	0.1028
- 20	0.1051
T	k
CURVE 41*	
91.47	0.1264
CURVE 42*	
91.60	0.1245
CURVE 43*	
91.77	0.1088
Ψ (deg)	k
CURVE 44 (T = 91.69-91.96 K)	
10	0.1205
40	0.1103
70	0.1028
100	0.1008
130	0.1031
160	0.1100
-170	0.1208
- 80	0.1020
CURVE 45* (T = 91.37-91.40 K)	
10	0.1193
- 80	0.1003
100	0.0983

T	k
CURVE 46*	
91.77	0.1143
CURVE 47	
91.96	0.0939
Ψ (deg)	k
CURVE 48* (T = 91.71-92.04 K)	
10	0.1143
40	0.1909
70	0.0945
100	0.0938
130	0.0950
160	0.1000
-170	0.1150
-140	0.1036
-110	0.0978
- 80	0.0965
- 50	0.0978
- 20	0.1002
T	k
CURVE 49	
79.2	0.1465
CURVE 50	
80.81	0.1429
CURVE 51*	
79.22	0.1432
CURVE 52	
79.32	0.1253
CURVE 53	
79.13	0.1404

T	k
CURVE 54*	
79.37	0.1184
CURVE 55*	
79.30	0.1362
CURVE 56	
79.36	0.1152
CURVE 57	
79.40	0.1335
CURVE 58	
79.41	0.1128
CURVE 59	
79.20	0.1327
CURVE 60*	
79.43	0.1123
CURVE 61	
79.42	0.1167
CURVE 62*	
91.21	0.1833
Ψ (deg)	k
CURVE 63* (T = 91.19-91.45 K)	
8	0.1583
10	0.1585
25	0.1593
45	0.1584
68	0.1611
85	0.1635
100	0.1619

Ψ (deg)	k
CURVE 63 (cont.)*	
115	0.1590
137	0.1569
160	0.1570
-172	0.1566
-150	0.1597
-135	0.1575
-120	0.1603
-112	0.1609
- 95	0.1634
- 65	0.1590
- 43	0.1581
- 20	0.1582
- 10	0.1584
CURVE 64* (T = 91.60-91.79 K)	
7	0.1515
40	0.1479
55	0.1452
85	0.1469
115	0.1405
124	0.1424
145	0.1427
175	0.1451
-173	0.1474
-155	0.1451
-125	0.1435
-110	0.1447
- 95	0.1472
- 80	0.1428
- 65	0.1430
- 56	0.1440
- 35	0.1448
- 5	0.1495
T	k
CURVE 65	
79.9	0.187
80.5	0.186
84.5	0.178
89.1	0.176
296.5	0.110

θ (deg)	k
CURVE 66* (T = 80.1K)	
25	0.155
35	0.155
170	0.156
CURVE 67* (T = 89.4-90.5 K)	
35	0.143
95	0.143
170	0.142
T	k
CURVE 68	
90	0.0976
273	0.0683
CURVE 69	
90	0.266
273	0.113
CURVE 70*	
298.2	0.0778
CURVE 71	
372.3	0.121
382.6	0.123
387.4	0.122
388.6	0.122*
402.4	0.122
421.8	0.121
440.3	0.120
444.4	0.119
451.5	0.118
462.1	0.118
472.5	0.115
475.1	0.115*
490.3	0.114
501.1	0.111

*Not shown on plot

DATA TABLE NO. 5 (continued)

T	k
CURVE 72	
2.05	4.3
2.85	10.0
3.65	15.0
4.13	14.5
CURVE 73*	
81.95	0.2008
82.5	0.2008
85.2	0.1969
85.75	0.1963
86.2	0.1961
88.65	0.1894
89.75	0.1894
CURVE 74*	
82.5	0.198
82.7	0.198
84.7	0.1951
86.2	0.1932
87.6	0.1903
88.9	0.1869
89.2	0.186
CURVE 75*	
77.76	0.147
90.17	0.129
CURVE 76*	
78.31	0.154
90.0	0.137
CURVE 77*	
78.37	0.204
89.66	0.185
CURVE 78*	
90.02	0.175

T	k
CURVE 79*	
91.8	0.1268
CURVE 80*	
92.2	0.0994
CURVE 81*	
79.6	0.1443
CURVE 82*	
79.8	0.1232
CURVE 83*	
79.9	0.1164
CURVE 84*	
79.9	0.1150
CURVE 85*	
79.9	0.1135
CURVE 86*	
91.0	0.1361
θ(deg)	**k**
CURVE 87* (T = 91.2 K)	
4	0.1101
38	0.1080
T	**k**
CURVE 88*	
78.7	0.1220
91.2	0.1042

T	k
CURVE 89*	
78.5	0.1535
θ(deg)	**k**
CURVE 90* (T = 78.7 K)	
-4	0.1281
38	0.1236
T	**k**
CURVE 91*	
78.7	0.1227
CURVE 92*	
79.1	0.2031
91.1	0.1828
CURVE 93*	
91.1	0.1542
CURVE 94*	
91.4	0.1457
CURVE 95*	
79.3	0.1723
CURVE 96*	
91.25	0.1733
CURVE 97	
91.30	0.1691
CURVE 98	
91.26	0.1608

θ(deg)	k
CURVE 99* (T = 91.23-91.36 K)	
2	0.1617
32	0.1541
62	0.1501
86	0.1492
116	0.1499
146	0.1530
-178	0.1625
-148	0.1562
-124	0.1536
-94	0.1539
-64	0.1536
-34	0.1540
T	**k**
CURVE 100*	
91.24	0.1537
CURVE 101*	
91.29	0.1474
CURVE 102*	
91.55	0.1403
CURVE 103*	
91.56	0.1416
θ(deg)	**k**
CURVE 104* (T = 91.26-91.55 K)	
2	0.1371
32	0.1323
56	0.1312
86	0.1337
116	0.1371
146	0.1394
-178	0.1383
-148	0.1352

θ(deg)	k
CURVE 104 (cont.)*	
-124	0.1398
-94	0.1465
-64	0.1443
-34	0.1380
T	**k**
CURVE 105	
319.9	0.0904
342.3	0.0904
379.0	0.0891
407.8	0.0874
421.9	0.0858
425.3	0.0849
442.2	0.0837
462.0	0.0824
477.0	0.0828
500.2	0.0854
CURVE 106*	
373.2	0.0837
CURVE 107	
287.2	0.0527
CURVE 108	
287.2	0.0556
CURVE 109	
287.2	0.0594
CURVE 110	
287.2	0.0741
CURVE 111	
287.2	0.0849

T	k
CURVE 112*	
287.2	0.0879
CURVE 113	
287.2	0.0908
CURVE 114*	
83.2	0.208
273.2	0.0812
373.2	0.0506
CURVE 115	
313.3	0.0711
397.8	0.0669
460.4	0.0669
481.2	0.0628
537.8	0.0669
540.7	0.0753
556.8	0.142
573.3	0.138
598.6	0.142
629.7	0.142
CURVE 116	
626.2	0.151
636.7	0.144*
647.2	0.160
675.2	0.158*
684.2	0.155
693.2	0.156*
701.7	0.151
713.2	0.160*
724.2	0.163*
731.7	0.161
743.2	0.164*
749.7	0.165*
756.2	0.165*
761.2	0.165*
768.2	0.160*
772.2	0.160
782.0	0.169*
796.7	0.164*

T	k
CURVE 116 (cont.)	
823.2	0.169*
824.7	0.174
848.2	0.172*
853.2	0.174*
879.2	0.171*
882.2	0.177
896.2	0.170*
905.2	0.177*
937.2	0.176*
945.2	0.180
CURVE 117	
100	0.1274
119	0.1126
149	0.0968
199	0.0791
249	0.0672
300	0.0607
CURVE 118	
100	0.1781
120	0.1646
150	0.1480
200	0.1265
250	0.1117
300	0.0985
CURVE 119*	
273.2	0.0741
373.2	0.0686
H(gauss)	**k**
CURVE 120 (T = 1.46 K)	
1.02	0.0684
1.98	0.0684*
2.74	0.0682*
3.54	0.0682*
4.52	0.0681*
5.31	0.0680*

*Not shown on plot

DATA TABLE NO. 5 (continued)

H(gauss)	k
CURVE 120 (cont.)	
6.91	0.0675*
8.56	0.0675*
10.27	0.0671
11.47	0.0669*
12.15	0.0666*
13.25	0.0663
14.31	0.0659*
15.24	0.0655*
16.33	0.0652*
17.36	0.0649
17.98	0.0646*
CURVE 121* (T = 300.2 K)	
2499	0.0929
3046	0.0925*
4049	0.0922*
4999	0.0917
5970	0.0915
6427	0.0911
6948	0.0908
7746	0.0903
8671	0.0899
9802	0.0895
10554	0.0890
CURVE 122* (T - 300.2 K)	
0000	0.0933
1302	0.0930
1536	0.0930
1537	0.0930
1820	0.0926
2555	0.0919
2596	0.0919
3477	0.0917
3977	0.0916
5442	0.0905
5992	0.0902
7569	0.0893
7892	0.0888
9516	0.0882
9818	0.0869
10534	0.0868
10724	0.0872
10773	0.0870

H(gauss)	k
CURVE 123* (T - 300.2 K)	
0000	0.0542
1040	0.0538
2039	0.0530
2592	0.0520
3038	0.0519
4010	0.0509
4986	0.0500
5543	0.0493
5936	0.0491
6878	0.0483
6981	0.0485
7816	0.0477
8565	0.0471
9480	0.0464
9552	0.0468
10640	0.0457
11023	0.0450
11161	0.0456
CURVE 124 (T = 300.2 K)	
5071	0.0497
9847	0.0469
CURVE 125* (T = 300.2 K)	
4997	0.0502
5034	0.0504
9840	0.0474
9973	0.0475
T	**k**
CURVE 126	
453.2	0.0753
490.2	0.0711
537.2	0.0628
555.2	0.1297
619.2	0.1381
712.2	0.1465
770.2	0.1465

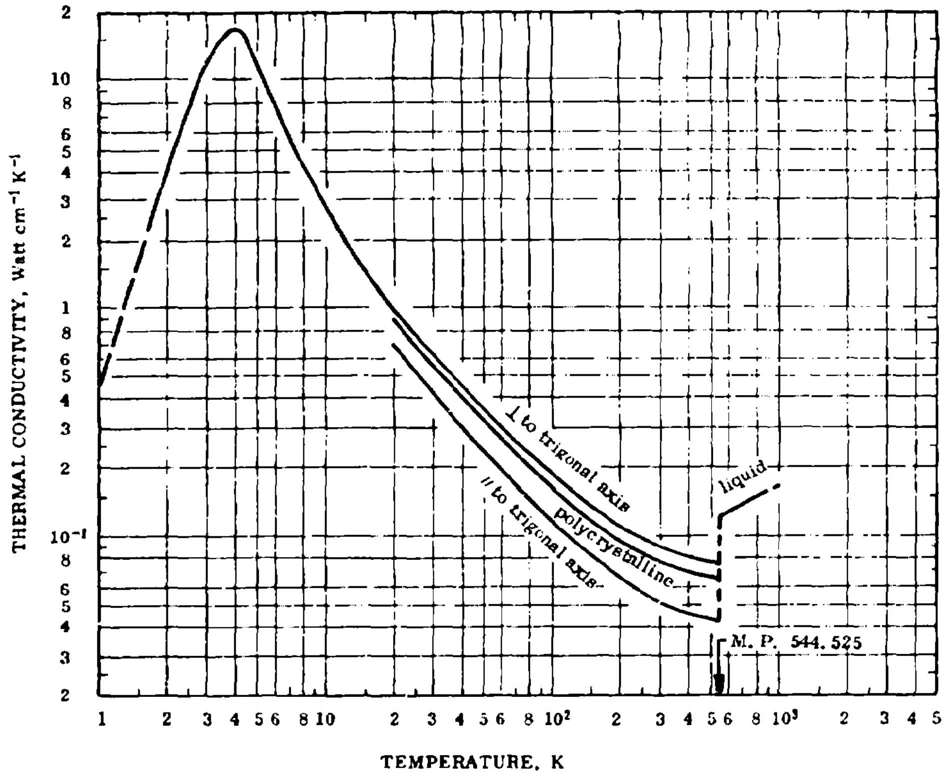
T	k
CURVE 127	
110.2	0.0887
119.4	0.0799
126.1	0.0770
137.5	0.0686
142.1	0.0661
146.3	0.0640
149.6	0.0615
152.6	0.0598
171.9	0.0536
186.5	0.0485
209.1	0.0477
CURVE 128	
117.1	0.0782
129.4	0.0686
141.4	0.0623
148.9	0.0577
156.3	0.0544
162.1	0.0519
172.7	0.0510
190.4	0.0481
CURVE 129*	
113.6	0.129
130.7	0.114
144.0	0.105
158.1	0.0987
169.8	0.0967
177.7	0.0941
197.7	0.0912
CURVE 130	
108.0	0.144
114.3	0.132
128.4	0.121
137.4	0.114
146.9	0.110
158.3	0.103
174.2	0.0992
215.6	0.0950

T	k
CURVE 131	
122.1	0.117
133.3	0.111
136.3	0.109
140.1	0.108
141.4	0.105
145.2	0.103
CURVE 132	
1.28	0.620
1.35	0.725
1.40	0.821
1.42	0.843
1.47	0.934
1.49	0.973
1.54	1.07
1.61	1.22
1.68	1.38
1.79	1.68
1.91	2.01
CURVE 133	
1.26	0.563
1.31	0.643
1.36	0.725
1.41	0.813
1.48	0.948
1.52	1.04
1.61	1.28
1.72	1.55
1.82	1.86
1.95	2.36
2.01	2.65
CURVE 134*	
80	0.134
156	0.0753
198	0.0672
252	0.0572
301	0.0530
CURVE 135*	
81	0.194
105	0.158
155	0.134

T	k
CURVE 135 (cont.)*	
197	0.115
252	0.100
303	0.0925

*Not shown on plot

FIGURE AND TABLE NO. 5R RECOMMENDED THERMAL CONDUCTIVITY OF BISMUTH



RECOMMENDED VALUES*

	Single Crystal (⊥ to c-axis)		Single Crystal (// to c-axis)		Polycrystalline		
T_1	k_1	k_2	k_1	k_2	k_1	k_2	T_2
0	0	0	0	0	0	0	-459.7
1	(0.452)‡	(26.1)					-457.9
2	3.94	228					-456.1
3	11.8	682					-454.3
4	17.1	988					-452.5
5	11.9	688					-450.7
6	7.98	461					-448.9
7	5.77	333					-447.1
8	4.40	254					-445.3
9	3.50	202					-443.5
10	2.88	166					-441.7
11	2.45	142					-439.9
12	2.11	122					-438.1
13	1.85	107					-436.3
14	1.65	95.3					-434.5
15	1.48	85.5					-432.7
16	1.36	78.6					-430.9
18	1.15	66.4					-427.3
20	1.00	57.8	0.700	40.4	0.900	52.0	-423.7
25	0.780	45.1	0.538	31.1	0.695	40.2	-414.7
30	0.635	36.7	0.434	25.1	0.568	32.8	-405.7
35	0.536	31.0	0.364	19.6	0.478	27.6	-396.7
40	0.465	26.9	0.311	18.0	0.414	23.9	-387.7
45	0.410	23.7	0.272	15.7	0.365	21.1	-378.7
50	0.367	21.2	0.243	14.0	0.326	18.8	-369.7
60	0.303	17.5	0.199	11.5	0.268	15.5	-351.7
70	0.260	15.0	0.168	9.71	0.231	13.3	-333.7
80	0.230	13.3	0.148	8.55	0.203	11.7	-315.7
90	0.206	11.9	0.131	7.57	0.182	10.5	-297.7
100	0.188	10.9	0.119	6.88	0.165	9.53	-279.7
150	0.136	7.86	0.0826	4.77	0.118	6.82	-189.7
200	0.112	6.47	0.0667	3.85	0.0969	5.60	- 99.7
250	0.0995	5.75	0.0581	3.36	0.0857	4.95	- 9.7
273.2	0.0953	5.51	0.0554	3.20	0.0822	4.75	32.0
300	0.0915	5.29	0.0528	3.05	0.0786	4.54	80.3
350	0.0860	4.97	0.0491	2.84	0.0737	4.26	170.3

REMARKS

The recommended values are for 99.997+% pure bismuth. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures above 10 K. The thermal conductivity near and below the corresponding temperature of its maximum is highly sensitive to small physical and chemical variations of the specimens, and the values below 10 K are intended as typical values for indicating the general trend.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

TABLE NO. 5R (continued)

	Single Crystal				Polycrystalline		
	(⊥ to c-axis)		(// to c-axis)				
T_1	k_1	k_2	k_1	k_2	k_1	k_2	T_2
400	0.0822	4.75	0.0469	2.71	0.0704	4.07	260.3
500	0.0775	4.48	0.0438	2.53	0.0663	3.83	440.3
544.525	0.0761	4.40	0.0429	2.48	0.0650	3.76	520.457

In Liquid State

T_1	k_1	k_2	T_2
544.525	0.124	7.16	520.457
600	0.131	7.57	620.3
700	0.141	8.15	800.3
800	0.150	8.67	980.3
900	0.159	9.19	1160
1000	(0.168)‡	(9.71)	1340

‡ Values in parentheses are extrapolated.

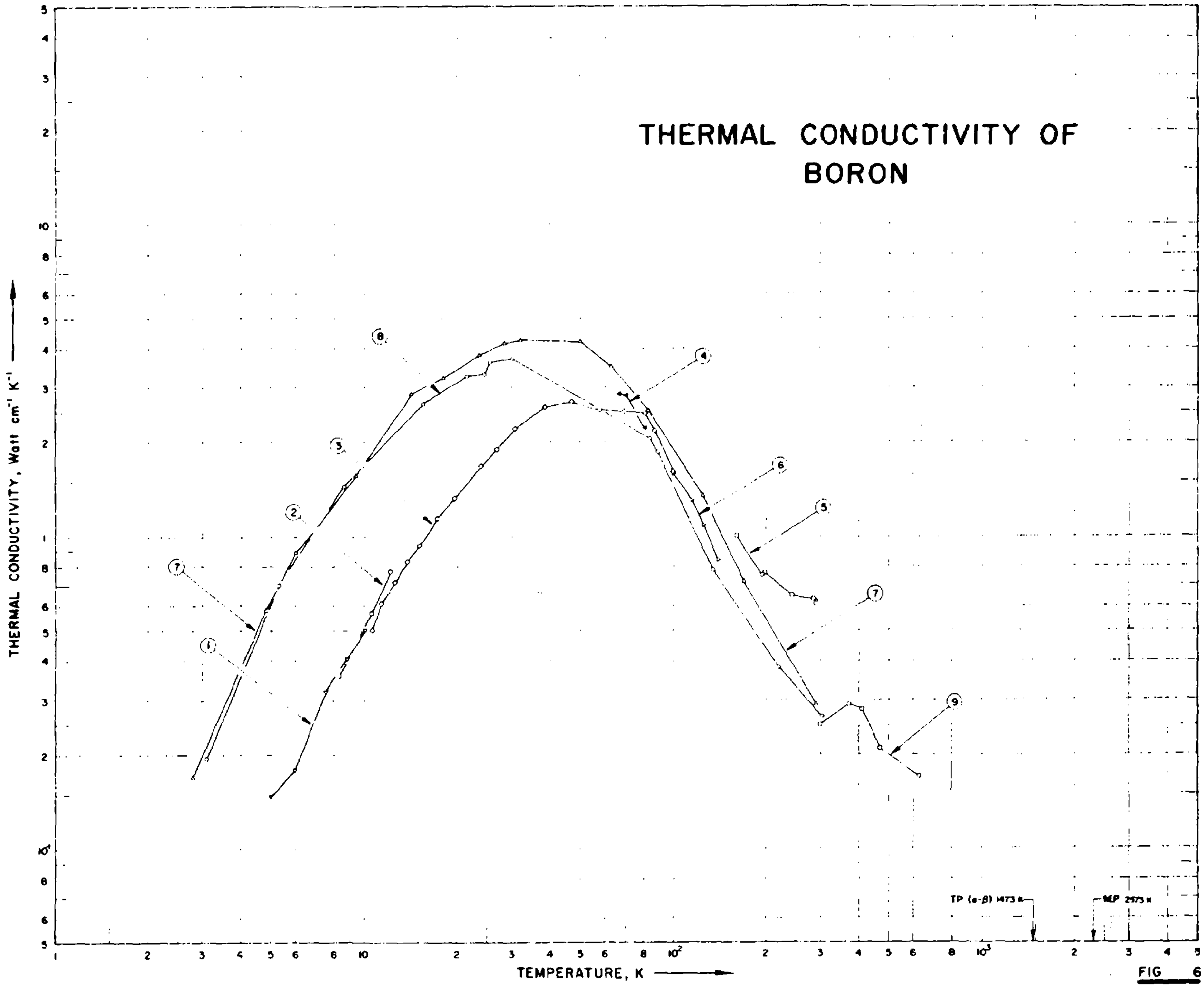

THERMAL CONDUCTIVITY OF BORON
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
TP (α-β) 1473 K
MP 2573 K
1
2
3
4
5
6
7
8
9

FIG 6

SPECIFICATION TABLE NO. 6 THERMAL CONDUCTIVITY OF BORON

(Impurity < 0.20% each, total impurities < 0.50%)

[For Data Reported in Figure and Table No. 6]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	790	L	1963	5-10			99.9 B (by difference), 0.1 C, cylindrical specimen 0.26 cm average diameter 3.8 cm long made from single crystal of the beta-rhombohedral phase, provided by Texaco Experiment Inc.; density 2.342 ± 0.005 g cm^{-3}; electrical resistivity > 5 x 10^6 ohm cm at room temperature. Debye temperature 1219 K.
2	790	L	1963	8-12			Rerun of the above specimen.
3	790	L	1963	10-100			Rerun of the above specimen.
4	790	L	1963	67-80			Rerun of the above specimen.
5	790	L	1963	162-290			Rerun of the above specimen.
6	790	L	1963	100-140			Rerun of the above specimen.
7	776	L	1965	2.8-291		R 4	Major impurities: 10 x 10^{19} Si, 20 x 10^{18} Al, 20 x 10^{16} Mn, 6 x 10^{17} Ti, and 4 x 10^{18} Cu atoms cm^{-3}, also about 0.1% (by volume) of precipitated particles 5-50 μ in diameter (probably of boron nitride, silicon inclusions or small voids); polycrystalline with numerous columnar crystals of β-rhombohedral phase 1 cm long 0.3 cm average diameter; specimen 3.8 cm long 0.7 cm average diameter grown by partially purified boron by General Electric Research Lab.; density 2.33 g cm^{-3}.
8	776	L	1965	3.1-305		R 46	As above but composed of columns 2 cm long 0.1 cm average diameter; specimen 2.6 cm long, 0.6 cm average diameter; provided by Eagle-Picher Research Lab. Miami, Okla. (crystal reference No. M6005CP); grown from the melt by floating zone process.
9	335		1965	300-630			No details reported.
10	1009	R	1959	323			99+B and 0.02 total of Ca, Cu, Fe, Mg, and Si; polycrystalline specimen 1 mm in diameter and several cm long with a 0.025 mm; tungsten filament at the center amounting to about 0.7% by weight; prepared by the reduction of boron tribromide by hydrogen near the tungsten filament at about 1250 C; data reported as the average for the range 20 to 80 C.

DATA TABLE NO. 6 THERMAL CONDUCTIVITY OF BORON

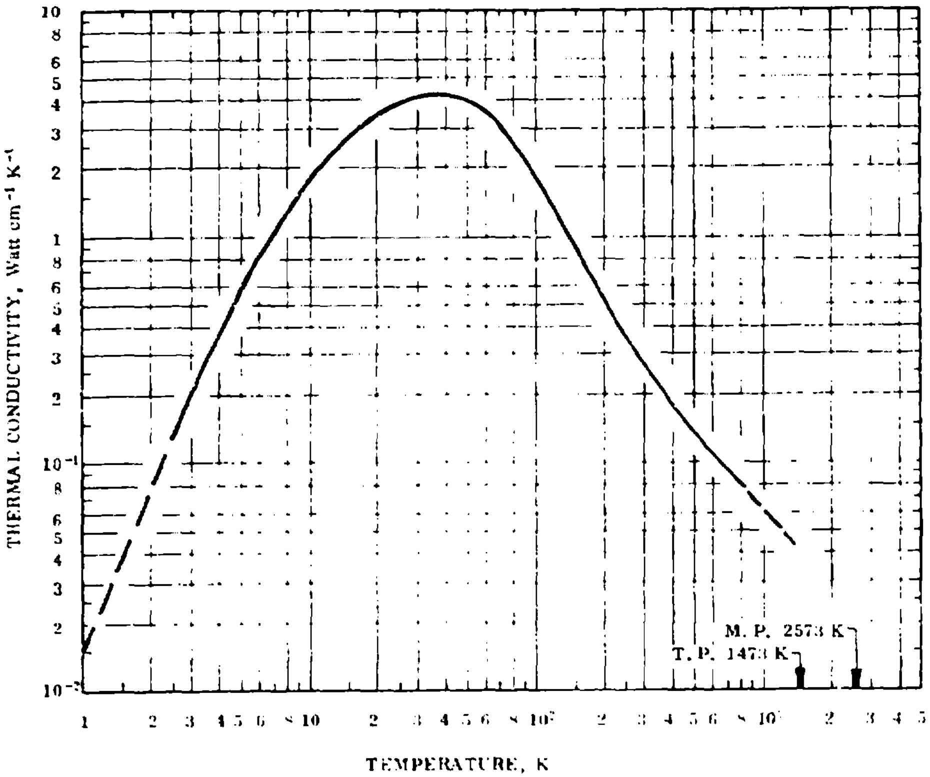
(Impurity < 0.20% each, total impurities < 0.50%)

[Temperature, T, K, Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
5.00	0.148
5.97	0.1793
7.50	0.320
8.80	0.405
10.09	0.501
CURVE 2	
8.31	0.357
10.58	0.570
12.21	0.773
CURVE 3	
10.61	0.502
11.44	0.613
12.60	0.712
13.82	0.834
15.07	0.936
17.23	1.115
19.57	1.335
23.95	1.674
26.88	1.893
30.75	2.205
38.06	2.595
46.92	2.688
57.53	2.546
79.23	2.515
80.86	2.476
86.86	2.157
99.74	1.612
CURVE 4	
66.70	2.86
70.36	2.80
80.54	2.219
CURVE 5	
161.8	1.019
194.4	0.747
CURVE 5 (cont.)	
196.6	0.745*
197.1	0.763
242.0	0.648
285.4	0.630
290.0	0.608
290.1	0.616
CURVE 6	
100.6	1.595
116.2	1.304
126.9	1.095
140.9	0.840
CURVE 7	
2.8	0.17
4.8	0.58
6.0	0.89
9.4	1.57
14.2	2.85
18.0	3.21
23.5	3.80
28.5	4.15
32.0	4.25
50.0	4.20
63.0	3.50
83.0	2.52
125.0	1.35
170.0	0.715
291.0	0.29
CURVE 8	
3.1	0.195
5.3	0.700
8.6	1.450
15.5	2.65
21.5	3.25
24.5	3.30
25.5	3.60
30.0	3.70
CURVE 8 (cont.)	
84.0	2.05
89.0	1.85
135.0	0.78
220.0	0.38
305.0	0.265
CURVE 9	
300	0.25
370	0.29
410	0.28
470	0.21
630	0.17
CURVE 10*	
323	0.0125

*Not shown on plot

FIGURE AND TABLE NO. 6R RECOMMENDED THERMAL CONDUCTIVITY OF BORON



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.141	8.15	440.3
1	(0.0150)‡	(0.867)	-457.9	600	0.113	6.53	620.3
2	(0.0781)	(4.51)	-456.1	700	(0.0941)	(5.44)	800.3
3	0.198	11.4	-454.3	800	(0.0809)	(4.67)	580.3
4	0.375	21.7	-452.5	900	(0.0708)	(4.09)	1160
5	0.588	34.0	-450.7	1000	(0.0629)	(3.63)	1340
6	0.826	47.7	-448.9	1100	(0.0569)	(3.29)	1520
7	1.07	61.8	-447.1	1200	(0.0518)	(2.99)	1700
8	1.31	75.7	-445.3	1300	(0.0472)	(2.73)	1880
9	1.54	89.0	-443.5	1400	(0.0437)	(2.52)	2060
10	1.77	102	-441.7				
11	1.98	114	-439.9				
12	2.19	127	-438.1				
13	2.39	138	-436.3				
14	2.58	149	-434.5				
15	2.76	159	-432.7				
16	2.93	169	-430.9				
18	3.22	186	-427.3				
20	3.46	200	-423.7				
25	3.92	226	-414.7				
30	4.21	243	-405.7				
35	4.30	248	-396.7				
40	4.28	247	-387.7				
45	4.19	242	-378.7				
50	4.04	233	-369.7				
60	3.63	210	-351.7				
70	3.10	179	-333.7				
80	2.63	152	-315.7				
90	2.24	129	-297.7				
100	1.90	110	-279.7				
150	0.910	52.6	-189.7				
200	0.525	30.3	-99.7				
250	0.363	21.0	-9.7				
273.2	0.317	18.3	32.0				
300	0.276	15.9	80.0				
350	0.224	12.9	170.3				
400	0.187	10.8	260.3				

REMARKS

The recommended values are for high-purity boron. The values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures above 80 K. The thermal conductivity near and below the corresponding temperature of its maximum is highly sensitive to small physical and chemical variations of the specimens, and the values below 80 K are intended as typical values for indicating the general trend.

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* T_1 in K, k_1 in Watt $cm^{-1} K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$.

‡ Values in parentheses are extrapolated.

THERMAL CONDUCTIVITY OF CADMIUM

FIGURE SHOWS ONLY 23 OF THE CURVES REPORTED IN TABLE

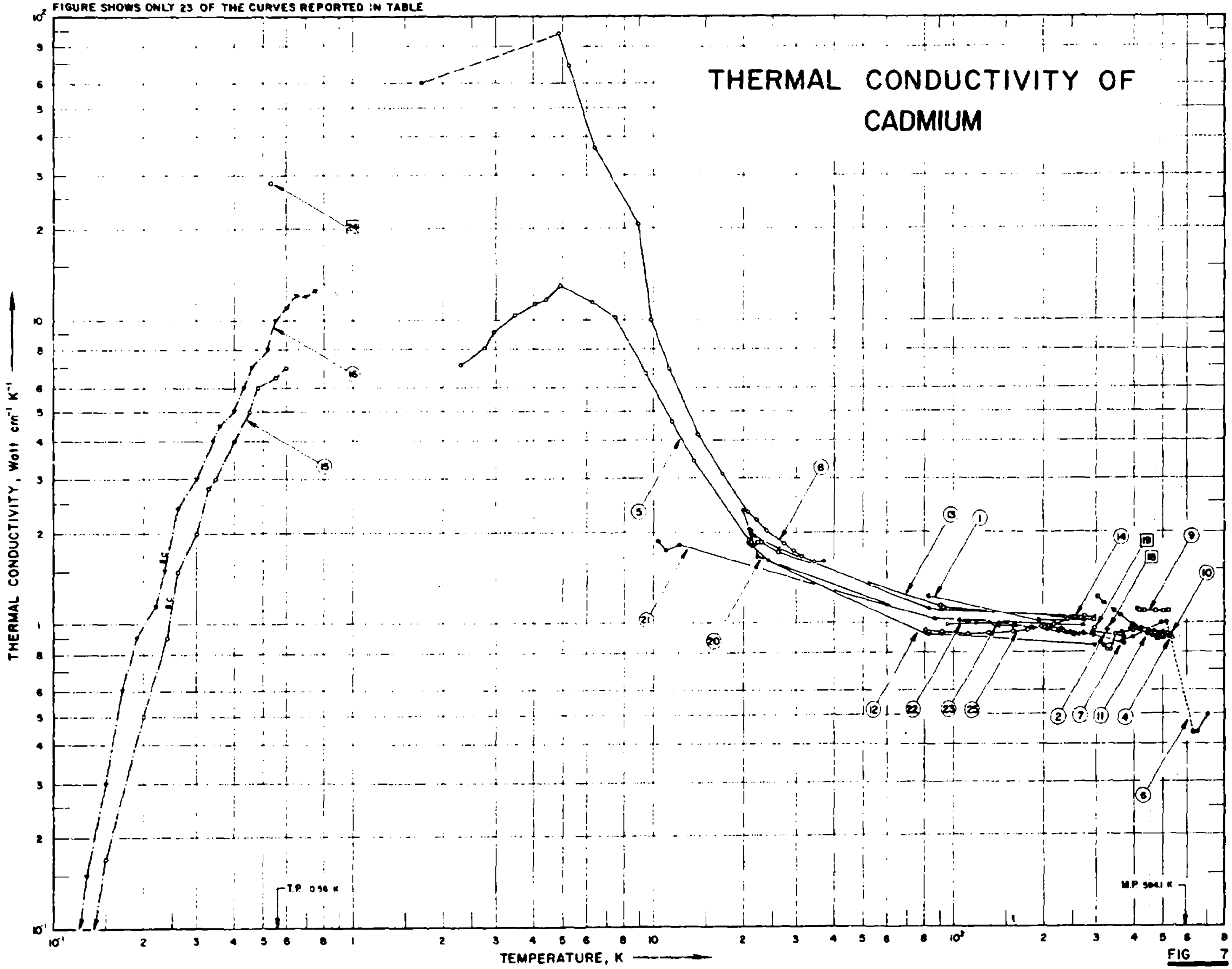


FIG 7

SPECIFICATION TABLE NO. 7 THERMAL CONDUCTIVITY OF CADMIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 7]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	35	L	1912	83-273			Specimen 2-3 cm in dia; electrical conductivity 5.05, 1.835, and 1.289 x 10^5 $ohm^{-1}cm^{-1}$ at -190, -79, and 0 C, respectively.
2	77	E	1900	291,373			< 0.05 ~~each of Pb, Zn, and Fe~~ (Fe+Pb+Zn), density 8.63 g cm^{-3} at 16 C; electrical conductivity 13.13 and 9.89 x 10^4 $ohm^{-1}cm^{-1}$ at 18 and 100 C, respectively.
3	77	E	1900	291,373			Similar to the above specimen but drawn into a wire; electrical conductivity 13.25 and 10.18 x 10^4 $ohm^{-1}cm^{-1}$ at 18 and 100 C, respectively.
4	6	L	1931	327-540			Specimen prepared from "pure redistilled Cadmium"; density 8.64 g cm^{-3} at 21 C; same specimen as used by Lees (Curves 22 and 23).
5	97	L	1952	2.3-21	2-3	Cd 1	99.9999 pure; polycrystalline; cast in glass.
6	19	L	1923	318-708			Specimen 1.5 cm in dia and 12 cm long; melting point 320 C.
7	796	L	1881	273,373			Density 8.62 g cm^{-3}; electrical conductivity 14.41 and 10.18 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively. (The paper reported 14.41 and 10.18 x 10^5 $ohm^{-1}cm^{-1}$, obviously a typographical error.)
8	122	L	1955	1.7-37	3	Cd 2	99.995 pure; single crystal; with heat flow at 79° to the hexagonal axis.
9	431	E	1944	414-526			Single crystal; electrical resistivity 10.08, 10.33, 10.90, 12.23, 13.20, and 14.10 µohm cm at 140.6, 146.9, 162.4, 202.0, 228.6, and 252.4 C, respectively.
10	431	E	1944	393-536			Polycrystal; electrical resistivity 11.84, 13.22, 14.34, 15.22, 16.65, 17.59, and 18.30 µohm cm at 119.6, 152.8, 177.2, 196.9, 228.2, 248.8, and 262.6 C, respectively.
11	383	E	1956	306-506			Pure; electrical conductivity at 12.89, 11.11, 9.51, 8.38, 7.60, and 7.32 x 10^4 $ohm^{-1}cm^{-1}$ at 32.5, 72.2, 122.2, 174.3, 207.5, and 232.6 C, respectively.
12	294	L	1932	21-297		Cd 53	Single crystal; specimen 0.1475 cm^2 in cross-sectional area and 6.70 cm long; angle between rod axis and hexagonal axis $\phi = 14°$, electrical resistivity at 0.185, 2.001, 7.65, and 8.27 µohm cm at -252, -190, 0, and 20 C, respectively.
13	294	L	1932	22-295		Cd 47a	Single crystal; specimen 0.1009 cm^2 in cross-sectional area and 4.48 cm long; $\phi = 84°$, electrical resistivity 0.1352, 1.63, 6.38, and 6.89 µohm cm at -252, -190, 0, and 20 C, respectively.
14	294	L	1932	21-297		Cd 47b	Similar to the above specimen except 0.0914 cm^2 in cross-sectional area and 6.65 cm long.
15	727	L	1960	0.10-0.60		Cd 1	Single crystal; heat flow along the hexagonal axis; includes superconducting state.
16	727	L	1960	0.10-0.75		Cd 3	Single crystal; heat flow perpendicular to the hexagonal axis; includes superconducting state.
17	230	L	1925	336.2			Impurities < 0.03; specimen in rod form 0.3 cm^2 in cross-sectional area and 5 to 6 cm long; electrical conductivity 13.76 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
18	230	L	1925	326.2			Similar to the above specimen except 1.9 cm in dia and 10 cm long.
19	511	L	1918	296.9			Specimen 1.1 cm in dia; supplied by Erba; measured in atmospheric pressure.

SPECIFICATION TABLE NO. 7 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
20	619	L	1916	20-273			Purified; specimen ~ 0.5 cm in dia and 5 cm long; electrical conductivity 622.0, 52.5, and 14.5 x 10^4 $ohm^{-1}cm^{-1}$ at 20.4, 87.0, and 273 K, respectively.
21	619	L	1916	20-273			Chemically pure (Kahlbaum); specimen ~ 0.5 cm in dia and 5 cm long; electrical conductivity ~~62.00~~ 678.4, 53.58, and 14.6 x 10^4 $ohm^{-1}cm^{-1}$ at 20.4, 87.0, and 273 K, respectively.
22	88	L	1908	96-297			Turned from a cast stick of "Pure Redistilled Cadmium" as used in Cadmium-Cell; specimen 0.585 cm in dia and 7-8 cm long; density 8.64 g cm^{-3} at 21 C; electrical resistivity 2.22, 2.56, 4.18, 5.05, 5.46, 6.38, 6.96, and 7.78 μohm cm at -178.1, -165.9, -105.8, -75.1, -59.9, -25.2, -5.7, and 22.8 C, respectively; first experiment.
23	88	L	1908	105-295			The above specimen, second experiment.
24	727	L	1960	0.53		Cd 2	Single crystal; heat flow perpendicular to the hexagonal axis; at the transition point.
25	851	L	1960	82-276	10		99.95 pure; specimen 0.1877 in. dia x 2.255 in. long turned from cast stick obtained from A.D. Mackay; data corrected for rise in temperature during measurement.

DATA TABLE NO. 7 THERMAL CONDUCTIVITY OF CADMIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
83.2	1.231
194.2	1.017
273.2	1.022

CURVE 2

T	k
291.2	0.927
373.2	0.899

CURVE 3

T	k
291.2	0.936
373.2	0.925

CURVE 4

T	k
327.2	0.812
336.2	0.812
349.2	0.916
367.2	0.925
399.2	0.937
420.2	0.946
447.2	0.916
463.2	0.900
491.2	0.920
501.2	0.900
522.2	0.920
526.2	0.895
540.2	0.883

CURVE 5

T	k
2.30	7.105
2.76	8.090
2.96	9.160
3.48	10.420
4.08	11.315
4.41	11.630
4.93	12.975
6.31	11.475
7.50	10.210
9.47	6.684

CURVE 5 (cont.)

T	k
11.57	4.605
13.74	3.421
20.91	1.895

CURVE 6

T	k
316.2	0.837
372.2	0.874
398.2	0.891
438.2	0.925
494.2	0.992
513.2	1.000
628.2	0.444
631.2	0.439
653.2	0.439
708.2	0.498

CURVE 7

T	k
273.2	0.920
373.2	0.856

CURVE 8

T	k
1.70	60.40
4.85	88.00
5.26	68.80
6.40	36.60
8.92	20.60
9.55	10.00
11.34	6.90
14.12	4.20
17.01	3.10
20.72	2.334
22.01	2.200
23.82	2.028
27.3[illegible]	1.840
29.3	1.748
[illegible]	1.672
[illegible].33	1.600
[illegible]7.01	1.600

CURVE 9

T	k
413.7	1.11
420.0	1.10
435.5	1.10
475.1	1.09
501.7	1.08
525.5	1.08

CURVE 10

T	k
392.7	0.958
425.9	0.950
450.3	0.941
470.0	0.933
501.3	0.920
521.9	0.912
535.7	0.908

CURVE 11

T	k
305.7	1.226
318.5	1.172
345.4	1.100
361.5	1.063
395.4	0.979
407.4	0.962
447.5	0.920
452.5	0.916
480.7	0.883
505.8	0.891

CURVE 12

T	k
20.8	1.34
21.3	1.80
24.1	1.62
81.8	0.915
83.4	0.914
91.6	0.910
296.3	0.840
296.8	0.840

CURVE 13

T	k
22.3	1.865
23.0	1.866
26.2	1.729
90.8	1.115
92.5	1.113
294.0	1.037
295.2	1.029
295.4	1.048
295.4	1.035

CURVE 14

T	k
20.8	2.05
21.2	2.02
21.7	1.95
26.3	1.754
82.4	1.132
82.8	1.123
91.4	1.118
296.5	1.040
296.8	1.031

CURVE 15

T	k
0.10	0.015
0.11	0.024
0.12	0.038
0.13	0.070
0.15	0.170
0.20	0.500
0.24	0.900
0.26	1.500
0.30	2.000
0.33	2.800
0.35	3.000
0.40	4.000
0.45	5.000
0.48	6.000
0.55	6.500
0.60	7.000

CURVE 16

T	k
0.10	0.030
0.106	0.050
0.11	0.060
0.115	0.0[illegible]
0.12	0.085
0.13	0.150
0.15	0.300
0.17	0.600
0.19	0.900
0.22	1.150
0.235	1.500
0.26	2.400
0.30	3.000
0.34	4.00
0.36	4.50
0.40	5.00
0.43	6.00
0.46	7.00
0.52	8.00
0.55	10.00
0.60	11.00
0.65	12.00
0.70	12.00
0.75	12.50

CURVE 17

T	k
336.2	0.971

CURVE 18

T	k
326.2	0.941

CURVE 19

T	k
296.9	0.907

CURVE 20

T	k
20.4	2.35
21.2	2.00
21.6	1.81

CURVE 20 (cont.)

T	k
22.4	1.67
82.2	1.04
87	1.03
273	0.94

CURVE 21

T	k
20.4	1.87
21.1	1.75
22.3	1.83
87	1.03
273	0.975

CURVE 22

T	k
96.2	0.983
120.2	0.996
133.2	1.000
144.2	0.996
155.2	0.979*
164.2	0.975
174.2	0.979*
187.2	0.958
213.2	0.958
232.2	0.950
249.2	0.929
264.2	0.937*
276.2	0.929*
286.2	0.920*
294.2	0.908*
297.2	0.904

CURVE 23

T	k
105.2	1.02
120.2	0.996*
132.2	0.983*
142.2	0.975
158.2	0.979
169.2	0.975*
182.2	0.962
194.2	0.962*

CURVE 23 (cont.)

T	k
205.2	0.946
225.2	0.933
238.2	0.925
252.2	0.908
263.2	0.916
275.2	0.925*
283.2	0.904*
292.2	0.895*
295.2	0.891*

CURVE 24

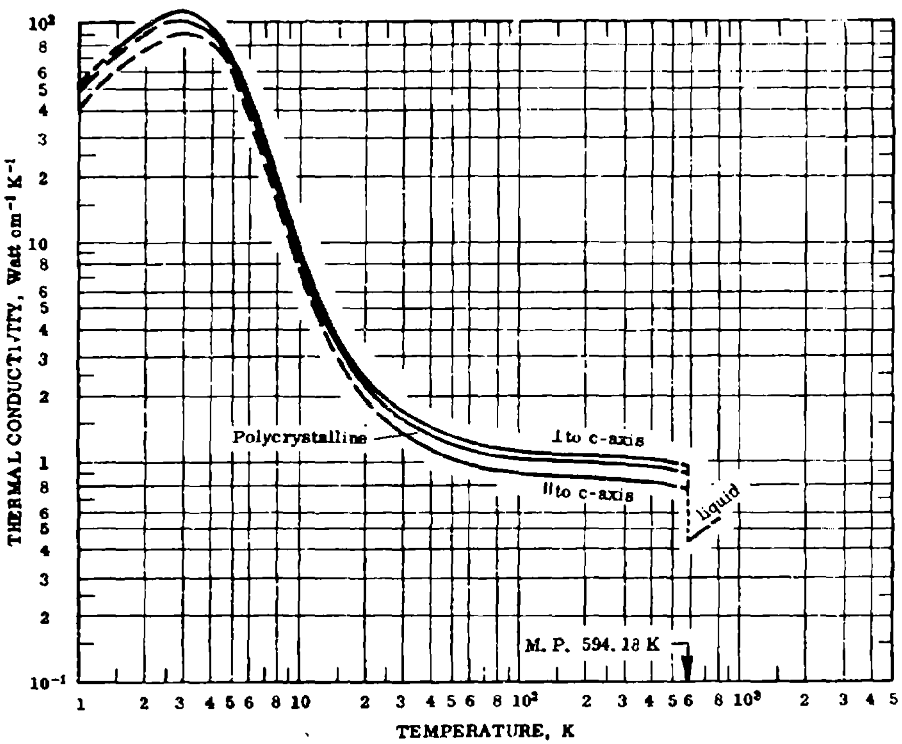
T	k
0.53	28.2

CURVE 25

T	k
81.51	0.940
92.83	0.926
113.92	0.914
133.64	0.918
159.26	0.930
177.79	0.941
198.18	0.966
217.36	0.985
241.08	1.03
256.73	1.05
275.62	1.05

*Not shown on plot

FIGURE AND TABLE NO. 7R RECOMMENDED THERMAL CONDUCTIVITY OF CADMIUM



RECOMMENDED VALUES*

	Single Crystal (⊥ to c-axis)		Single Crystal (// to c-axis)		Polycrystalline		
T_1	k_1	k_2	k_1	k_2	k_1	k_2	T_2
0	0	0	0	0	0	0	-459.7
1	(52.8)‡	(3050)	(40.3)	(2330)	(48.7)	(2810)	-457.9
2	96.3	5560	(74.7)	(4320)	(89.3)	(5160)	-456.1
3	111	6410	(89.5)	(5170)	104	6010	-454.3
4	96.6	5580	(81.8)	(4730)	92.0	5320	-452.5
5	71.9	4150	(61.3)	(3540)	69.0	3990	-450.7
6	47.3	2730	(37.8)	(2180)	44.2	2550	-448.9
8	19.3	1120	(15.4)	(890)	18.0	1040	-445.3
10	9.5	549	(7.6)	(439)	8.87	513	-441.7
15	3.8	220	(3.04)	(176)	3.55	205	-432.7
20	2.42	140	(1.94)	(112)	2.26	131	-423.7
25	1.92	111	1.54	89.0	1.79	103	-414.7
30	1.67	96.5	1.34	77.4	1.56	90.1	-405.7
35	1.51	87.2	1.21	69.9	1.41	81.5	-396.7
40	1.41	81.5	1.13	65.3	1.32	76.3	-387.7
50	1.28	74.0	1.03	59.5	1.20	69.3	-369.7
60	1.21	69.9	0.97	56.0	1.13	65.3	-351.7
70	1.16	67.0	0.93	53.7	1.08	62.4	-333.7
80	1.13	65.3	0.905	52.3	1.06	61.2	-315.7
90	1.11	64.1	0.892	51.5	1.04	60.1	-297.7
100	1.10	63.6	0.883	51.0	1.03	59.5	-279.7
150	1.08	62.4	0.864	49.9	1.01	58.4	-189.7
200	1.06	61.2	0.851	49.2	0.993	57.4	- 99.7
250	1.05	60.7	0.840	48.5	0.980	56.6	- 9.7
273.2	1.04	60.1	0.835	48.2	0.975	56.3	32.0
300	1.04	60.1	0.830	48.0	0.968	55.9	80.3
350	1.03	59.5	0.821	47.4	0.958	55.4	170.3
400	1.01	58.4	0.811	46.9	0.947	54.7	260.3
500	0.985	56.9	0.788	45.5	0.920	53.2	440.3
594.18	(0.942)	(54.4)	(0.754)	(43.6)	(0.880)	(50.8)	609.83

In Liquid State

T_1	k_1	k_2	T_2
594.18	0.416	24.0	609.83
600	0.420	24.3	620.3
700	0.490	28.3	800.3
800	(0.559)	(32.3)	980.3

REMARKS

The recommended values are for well-annealed 99.999+% pure cadmium with residual electrical resistivity ρ_0 = 0.000463, 0.000606, and 0.000502 $\mu\Omega$ cm, respectively, for single crystal along directions perpendicular and parallel to the c-axis and for polycrystalline cadmium (characterization by ρ_0 becomes important at temperatures below about 100 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.50, α' = 1.77 x 10^{-4}, and β = 0.0188 for the direction perpendicular to the c-axis; using n = 2.50, α' = 1.90 x 10^{-4}, and β = 0.0246 for the direction parallel to the c-axis; and using n = 2.50, α' = 1.80 x 10^{-4}, and β = 0.0204 for polycrystalline cadmium. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or estimated.

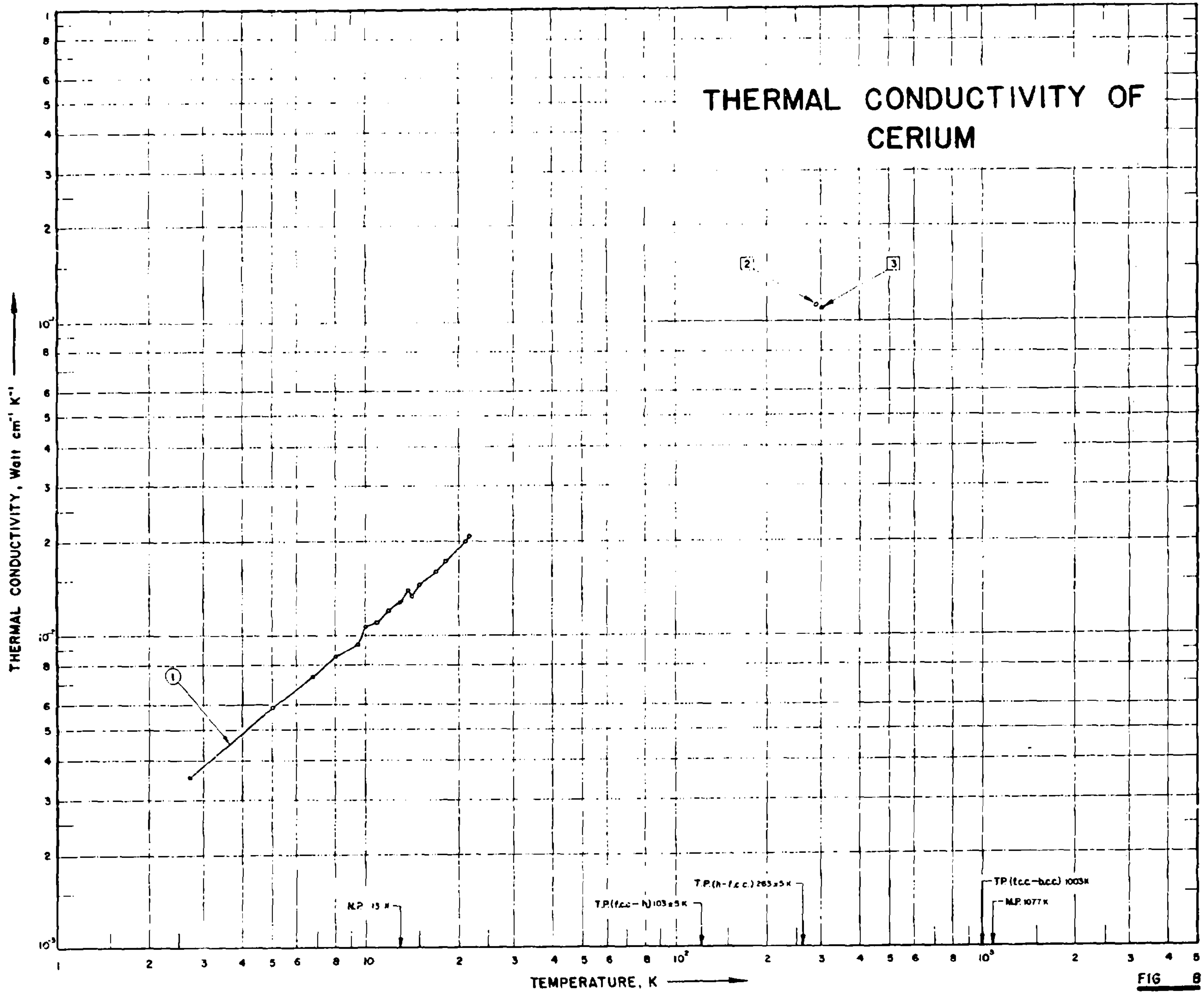

THERMAL CONDUCTIVITY OF CERIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
N.P. 13 K
T.P.(f.c.c.—h) 103±5 K
T.P.(h—f.c.c.) 263±5 K
T.P.(f.c.c.—b.c.c.) 1003 K
M.P. 1077 K

FIG 8

SPECIFICATION TABLE NO. 8 THERMAL CONDUCTIVITY OF CERIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 8]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	122	L	1955	2.7-22	3.0	Ce - 1	99.6 pure; Mg and Ca as major impurities; specimen 1.085 cm long and 0.38 cm square cross section; electrical resistivity ratio $\rho_{(293K)}/\rho_{(20K)}$ = 1.93.
2	777	C	1965	291.2	± 3		High purity rod of cerium, about 0.25 in. dia and 0.25 in. long obtained from Johnson Matthey and Co., Ltd.; electrical resistivity 74 μohm cm at ~18 C; monel metal used as comparative material; measurements made using 2 different comparators.
3	811		1954	301.2	10		No details reported.

DATA TABLE NO. 8 THERMAL CONDUCTIVITY OF CERIUM

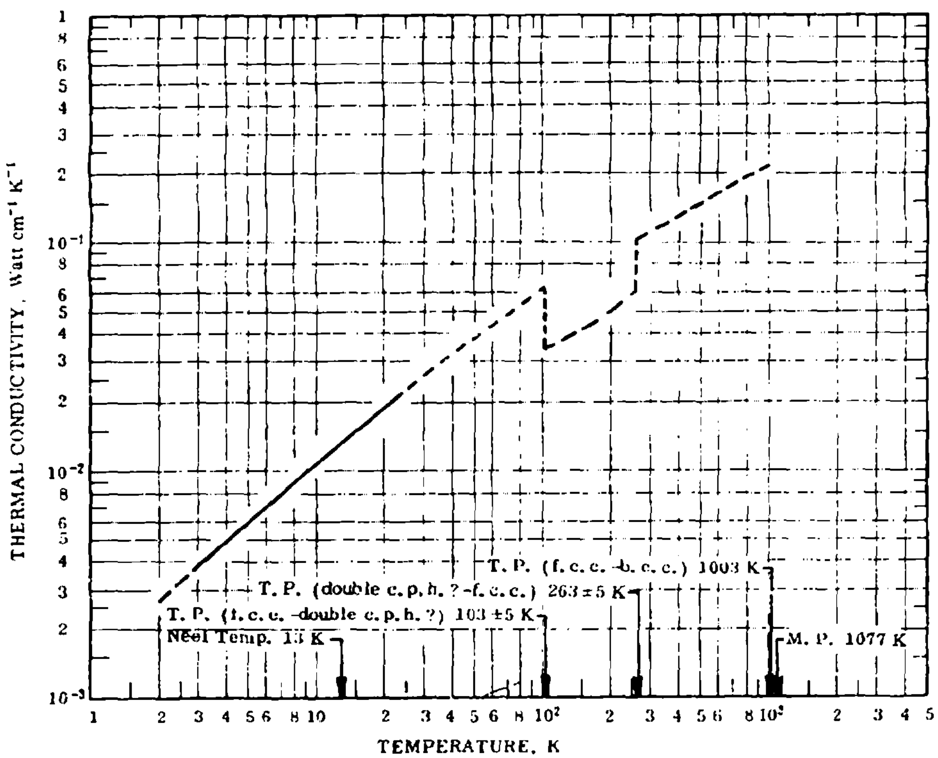
(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
2.71	0.00354
5.00	0.00589
6.77	0.00734
8.04	0.00852
9.48	0.00939
10.0	0.0107
10.9	0.0111
11.9	0.0120
13.0	0.0127
13.7	0.0139
14.2	0.0133
15.0	0.0145
17.0	0.0160
18.3	0.0173
21.2	0.0200
21.7	0.0208
CURVE 2	
291.2	0.112
291.2	0.112*
CURVE 3	
301.2	0.109

*Not shown on plot

FIGURE AND TABLE NO. 8R RECOMMENDED THERMAL CONDUCTIVITY OF CERIUM



RECOMMENDED VALUES
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	300	0.114	6.59	80.3
2	(0.00260)‡	(0.150)	-456.1	350	(0.124)	(7.16)	170.3
3	0.00373	0.216	-454.3	400	(0.133)	(7.68)	260.3
4	0.00482	0.278	-452.5	500	(0.150)	(8.67)	440.3
5	0.00584	0.337	-450.7	600	(0.166)	(9.59)	620.3
6	0.00683	0.395	-448.9	700	(0.180)	(10.4)	800.3
7	0.00776	0.448	-447.1	800	(0.193)	(11.2)	980.3
8	0.00868	0.502	-445.3	900	(0.206)	(11.9)	1160
9	0.00959	0.554	-443.5	1000	(0.218)	(12.6)	1340
10	0.0105	0.607	-441.7				
11	0.0113	0.653	-439.9				
12	0.0121	0.705	-438.1				
13	0.0130	0.751	-436.3				
14	0.0138	0.797	-434.5				
15	0.0147	0.849	-432.7				
16	0.0155	0.896	-430.9				
18	0.0171	0.988	-427.3				
20	0.0186	1.07	-423.7				
25	(0.0224)	(1.29)	-414.7				
30	(0.0260)	(1.50)	-405.7				
35	(0.0293)	(1.69)	-396.7				
40	(0.0323)	(1.87)	-387.7				
45	(0.0352)	(2.03)	-378.7				
50	(0.0379)	(2.19)	-369.7				
60	(0.0432)	(2.50)	-351.7				
70	(0.0478)	(2.76)	-333.7				
80	(0.0521)	(3.01)	-315.7				
90	(0.0561)	(3.24)	-297.7				
100	(0.0600)	(3.47)	-279.7				
103±5	(0.0610)	(3.52)	-274.3±9				
103±5	(0.0340)	(1.96)	-274.3±9				
150	(0.0406)	(2.35)	-189.7				
200	(0.0500)	(2.89)	-99.7				
250	(0.0583)	(3.37)	-9.7				
263±5	(0.0602)	(3.48)	13.7±9				
263±5	(0.105)	(6.07)	13.7±9				
273.2	(0.108)	(6.24)	32.0				

REMARKS

The recommended values are for well-annealed 99.6 % pure cerium. The values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures. Since the thermal conductivity at low temperature is highly sensitive to small physical and chemical variations of the specimens, the values below about 100 K would be higher for specimens of higher purity.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or estimated.

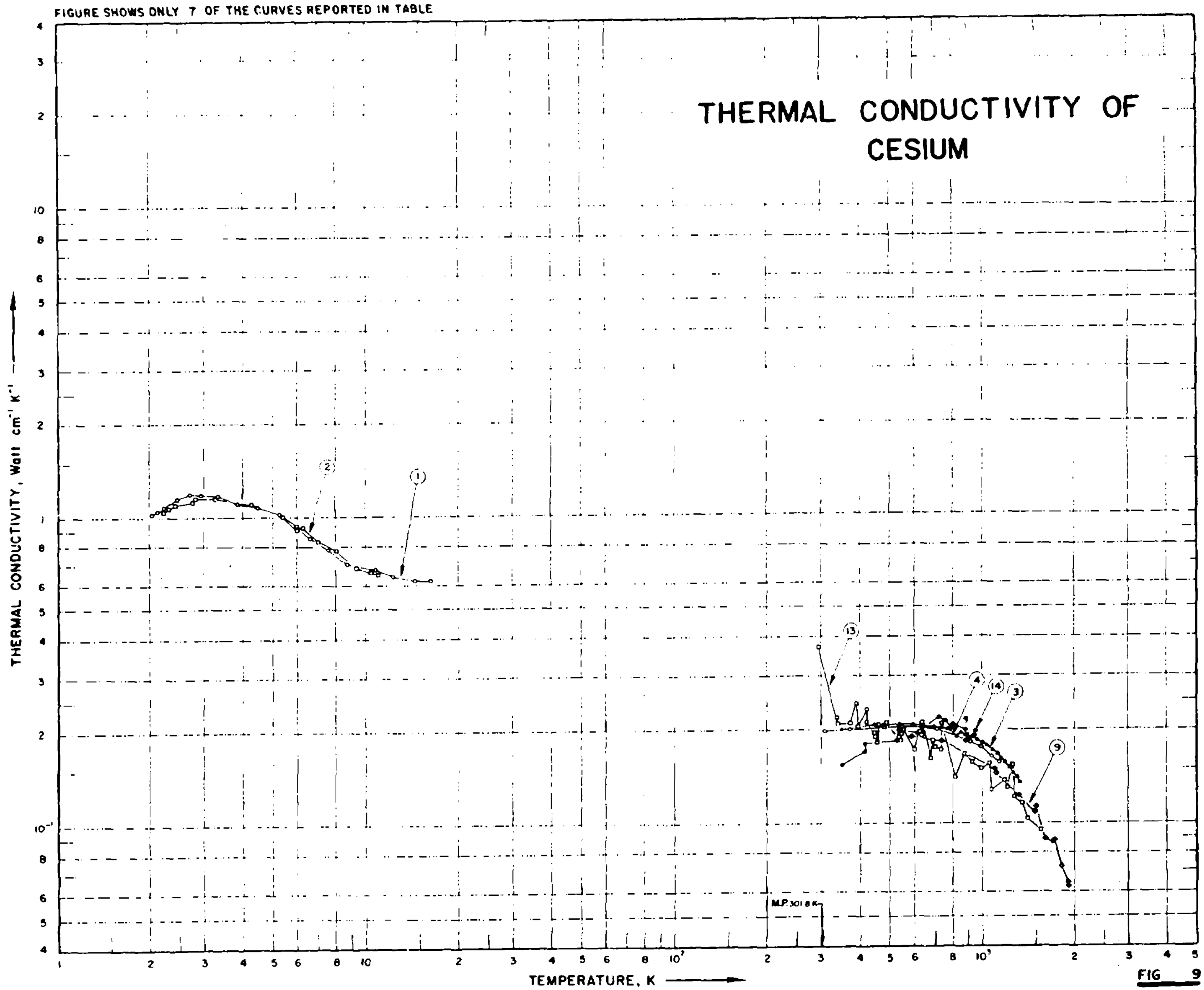


FIGURE SHOWS ONLY 7 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF CESIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 301.8 K
1
2
3
4
13
14
9

FIG 9

SPECIFICATION TABLE NO. 9 THERMAL CONDUCTIVITY OF CESIUM

[For Data Reported in Figure and Table No. 9]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	92	L	1956	2.0-16		Cs 3	High purity; 1.6 mm in dia; melted in vacuo and run into soft-glass tube; run No. 1 yielded the following information: electrical resistivity ratio $\rho(295\ K)/\rho(0\ K)$ = 498 (using Hackspill's value ρ = 20.8 μohm cm at 295 K); $\rho(0\ K)$ = 0.0418 μohm cm; Lorenz function 2.51 x $10^{-8}\ V^2K^{-2}$ at 0 K.
2	92	L	1956	2.2-11		Cs 3	The above specimen second run; electrical resistivity ratio $\rho(295\ K)/\rho(0\ K)$ = 465 (using Hackspill's value ρ = 20.8 μohm cm at 295 K); $\rho(0\ K)$ = 0.0447 μohm cm; Lorenz function 2.47 x $10^{-8}\ V^2K^{-2}$ at 0 K.
3	655, 860	-	1964	349-1336			99.99 pure liquid specimen; thermal conductivity values calculated from electrical resistivity measurements using the theoretical Lorenz number; electrical resistivity reported as 20.29, 37.39, 42.57, 52.63, 63.59, 70.72, 83.92, 94.45, 112.48, 127.78, 153.48, 173.79, 211.94, and 241.12 μohm cm at 18.3, 28.3, 76.174, 267, 326, 427, 503, 614, 696, 811, 887, 993, and 1063 C, respectively.
4	756	-	1962	309-1050	10		Impurities (pretest): < 0.0010 O, < 0.0010 N, < 0.0045 C, < 0.0042 Rb, and traces of Si, Mg, Al, Cu, Na, Ca, and Fe; impurities (posttest): 0.0017 O, 0.0020 N, < 0.0020 C, < 0.0100 Rb, and traces of Si, Mg, Al, Cu, Na, Ca, and Fe; liquid specimen; supplied by MSA Research Corp.; thermal conductivity values calculated from electrical resistivity data using the theoretical Lorenz number 2.45 x $10^{-8}\ V^2K^{-2}$; electrical resistivity reported as 37.42, 38.32, 45.77, 65.74, 77.28, 87.35, 123.63, 139.29, 161.26, and 178.63 μohm cm at 28.3, 35.8, 101.4, 276.9, 370.6, 444.2, 650.0, 725.8, 815.3, and 876.7 C, respectively.
5	863	-	1966	672.2			99.99 pure; vapor specimen filled in a test cell which is an 8-in. long (2.25 in.) schedule 40 pipe constructed from Hasteloy-C and is connected with a boiler; measured at a boiler pressure of 20 mm Hg; thermal conductivity measured by using the dynamic hot-wire method.
6	863	-	1966	739.2			Same as the above specimen except boiler pressure 40 mm Hg.
7	863	-	1966	738.2			Same as the above specimen except boiler pressure 62 mm Hg (saturated).
8	863	-	1966	839.2			Same as the above specimen except boiler pressure 65 mm Hg.
9	873, 874	-	1965	589-1913	1.3	Run 1	~ 99.97 Cs, 0.0154 O_2, 0.0145 Rb, 0.004 Na, 0.0023 Ca, 0.0018 Fe, 0.0016 B, 0.0013 Si, 0.0006 K, 0.0003 each of Mg, Ar and Ni; saturated liquid specimen filled in a test capsule 12 in. long, 1 in. OD and 1/16 in. in wall thickness with 1/4 in. thick discs welded to the ends of the tube made from Ta-10W alloy; specimen supplied by Dow Chemical Co.; thermal conductivity values calculated from electrical resistivity data using Lorenz number of 2.3 x $10^{-8}\ V^2K^{-2}$; electrical resistivity reported as 69.42, 77.54, 86.23, 95.54, 105.4, 116.2, 127.4, 139.7, 152.5, 166.6, 181.7, 197.6, 216.9, 235.4, 257.0, 280.8, 306.7, 336.7, 370.1, 403.8, 451.0, 500.5, 557.9, 618.2, and 702.4 μohm cm at 316, 371, 427, 482, 538, 593, 649, 704, 760, 816, 871, 927, 982, 1038, 1093, 1149, 1204, 1260, [illegible]6, 1371, 1427, 1482, 1538, 1593, and 1649 C, respectively; critical temperature of Cs was estimated to be 2027 K.

SPECIFICATION TABLE NO. 9 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
10	873, 874	-	1965	589-1910	1.3	Run 2	Similar to the above; second loading of the test capsule.
11	873, 874	-	1965	589-1914	1.3	Run 3	Similar to the above; third loading of the test capsule.
12	875		1962	[illegible]45-1157			Vapor specimen.
13	287	C	1964	295-1556	5		99.994 pure (estimated from freezing point curve and emission spectrography for impurities); freezing point 28.52 C; specimen clad in Nb-1Zr alloy; specimen in liquid state except at 295.2 K where it was mostly solid; electrical resistivity reported as 44, 55, 67, 80, 96, 114, 134, 155, 179, 208, and 246 μohm cm at 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, and 1100 C, respectively; Nb-1Zr alloy used as comparative material.
14	997, 998	C	1967	350-950	±7-±14		0.05 Na, 0.033 Rb, and 0.0133 K; liquid specimen contained in a hollow cylinder of I.D. 14 mm; prepared from cesium chloride by reduction with calcium and subsequent distillation in a vacuum of 10^{-1}–10^{-3} mm Hg; Armco iron used as comparative material.
15	997, 998	C	1967	358-969	±7-±14		Similar to the above specimen.
16	997, 998	C	1967	428-904	±7-±14		Similar to the above specimen.
17	997, 998	C	1967	460-904	±7-±14		Similar to the above specimen.

DATA TABLE NO. 9 THERMAL CONDUCTIVITY OF CESIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
2.02	1.03
2.13	1.05
2.22	1.08
2.46	1.15
2.70	1.19
2.94	1.18
3.34	1.17
3.85	1.11
4.49	1.08
5.26	1.03
5.99	0.943
6.62	0.856
7.59	0.782
8.76	0.703
10.8	0.676
12.2	0.642
14.5	0.624
16.3	0.624
CURVE 2	
2.21	1.04
2.30	1.07
2.43	1.10
2.76	1.12
2.93	1.15
3.28	1.15
4.29	1.10
5.40	1.01
6.00	0.913
6.28	0.928
7.03	0.834
8.04	0.778
9.39	0.683
10.4	0.665
11.0	0.651

T	k
CURVE 1	
2.16	1.040
2.28	1.067
2.39	1.098
2.43	1.146
2.70	1.186
3.24	1.156
3.86	1.109
4.28	1.102
5.37	1.010
6.10	0.924
7.00	0.828
8.70	0.701
10.84	0.666
12.10	0.643
14.40	0.624
16.20	0.624
CURVE 2	
295.2	0.371
337.2	0.219
341.2	0.209
375.2	0.211
391.2	0.244
398.2	0.206
423.2	0.233
425.2	0.212
425.2	0.210*
447.2	0.196
451.2	0.190
456.2	0.183
464.2	0.207
482.2	0.204
488.2	0.204*
493.2	0.211
543.2	0.186
549.2	0.194
556.2	0.199
601.2	0.173
630.2	0.197
637.2	0.192
639.2	0.210

T	k
CURVE 2 (cont.)	
685.2	0.162
691.2	0.185
701.2	0.200*
702.2	0.176
732.2	0.198*
739.2	0.172
741.2	0.209
819.2	0.141
878.2	0.168
932.2	0.157
995.2	0.150
997.2	0.148*
1067.2	0.156
1075.2	0.127
1157.2	0.164*
1180.2	0.137
1196.2	0.158*
1217.2	0.130
1258.2	0.154
1275.2	0.121
1354.2	0.116
1414.2	0.1034
1556.2	0.0948
CURVE 3	
349.2	0.201
447.2	0.208
478.2	0.207
540.2	0.208
599.2	0.208
649.2	0.206
700.2	0.204
742.2	0.203
776.2	0.201
826.2	0.198
854.2	0.196
887.2	0.193
931.2	0.189
966.2	0.186
969.2	0.186*

T	k
CURVE 3 (cont.)	
1007.2	0.182
1041.2	0.178
1084.2	0.173
1123.2	0.168
1160.2	0.163
1195.2	0.157
1229.2	0.152
1266.2	0.146
1301.2	0.142
1336.2	0.136
CURVE 4	
309.0	0.198
374.6	0.201
550.1	0.205
643.8	0.204
717.4	0.201
923.2	0.183
999.0	0.176
1088.5	0.165
1149.9	0.158
CURVE 5*	
672.2	0.000061
CURVE 6*	
739.2	0.000075
CURVE 7*	
738.2	0.000075
CURVE 8*	
839.2	0.000080

T	k
CURVE 9	
588.7	0.190
738.7	0.181*
740.4	0.184
885.4	0.184
1099	0.150
1210	0.145
1317	0.123
1488	0.108
1495	0.112
1593	0.0886
1694	0.0869
1702	0.0877
1815	0.0720
1913	0.0641
1913	0.0623
CURVE 10*	
588.7	0.193
740.9	0.183
740.9	0.188
886.5	0.179
1099	0.145
1100	0.143
1324	0.125
1491	0.112
1594	0.0968
1705	0.0866
1821	0.0736
1910	0.0641
CURVE 11*	
588.7	0.194
740.9	0.186
740.9	0.184
883.7	0.180
1101	0.145
1493	0.111
1709	0.0875
1817	0.0740
1914	0.0635

T	k
CURVE 12*	
945	0.0000115
1002	0.0000149
1061	0.0000176
1123	0.0000200
1187	0.0000220
CURVE 13	
295.2	0.371
337.2	0.219
341.2	0.209
375.2	0.211
391.2	0.244
398.2	0.206
423.2	0.233
425.2	0.212
425.2	0.210*
447.2	0.196
451.2	0.190
456.2	0.183
464.2	0.207
482.2	0.204
488.2	0.204*
493.2	0.211
543.2	0.186
549.2	0.194
556.2	0.199
601.2	0.173
630.2	0.197
637.2	0.192
639.2	0.210
685.2	0.162
691.2	0.185
701.2	0.200*
702.2	0.176
732.2	0.198*
739.2	0.172
741.2	0.209
819.2	0.141
878.2	0.168
932.2	0.157
995.2	0.150

T	k
CURVE 13 (cont.)	
997.2	0.148*
1067.2	0.156
1075.2	0.127
1157.2	0.164*
1180.2	0.137
1196.2	0.158*
1217.2	0.130
1258.2	0.154
1275.2	0.121
1354.2	0.116
1414.2	0.1034
1556.2	0.0948
CURVE 14	
350.2	0.156
416.2	0.171
416.2	0.181
469.2	0.182*
529.2	0.186
536.2	0.191*
537.2	0.202
617.2	0.195
637.2	0.207*
723.2	0.221
758.2	0.214
760.2	0.210*
797.2	0.203
892.2	0.208
887.2	0.200
887.2	0.218
900.2	0.186
944.2	0.191
950.2	0.199
CURVE 15*	
358.2	0.188
360.2	0.180
374.2	0.175
379.2	0.210
393.2	0.246

T	k
CURVE 15 (cont.)*	
398.2	0.205
398.2	0.235
425.2	0.227
423.2	0.195
440.2	0.214
462.2	0.242
494.2	0.210
531.2	0.230
554.2	0.209
581.2	0.236
587.2	0.239
590.2	0.216
611.2	0.207
613.2	0.227
662.2	0.245
665.2	0.203
[illegible]	0.231
691.2	0.231
695.2	0.202
701.2	0.200
706.2	0.215
777.2	0.201
795.2	0.231
802.2	0.202
815.2	0.196
817.2	0.229
819.2	0.218
912.2	0.193
969.2	0.186
969.2	0.221
CURVE 16*	
428.2	0.185
443.2	0.193
443.2	0.221
458.2	0.193
466.2	0.228
473.2	0.203
513.2	0.199
521.2	0.205
560.2	0.194

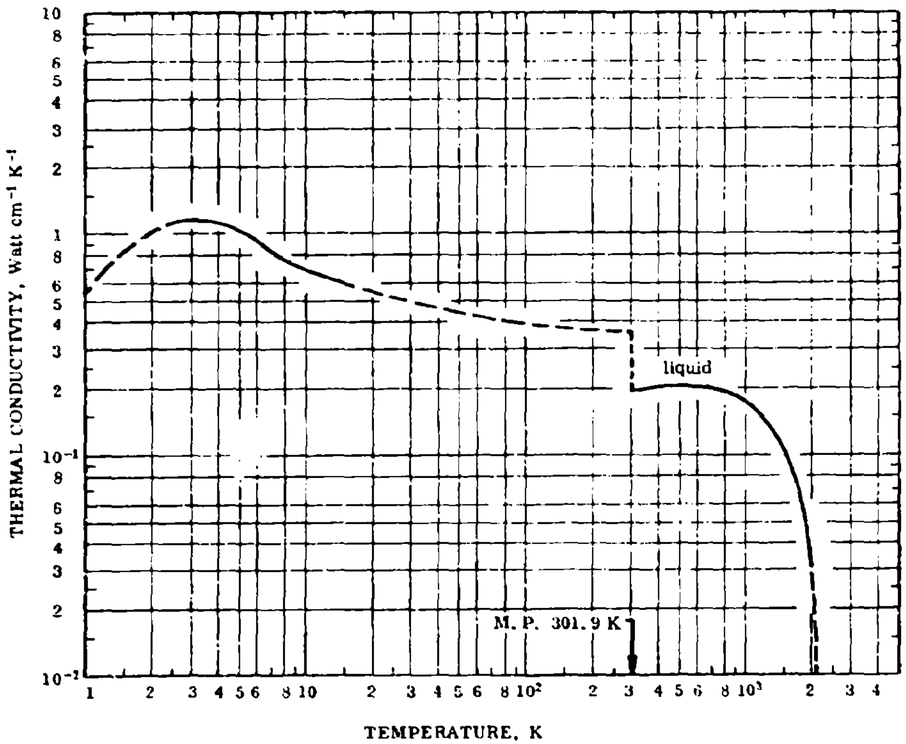
* Not shown on plot

DATA TABLE NO. 9 (continued)

T	k
CURVE 16 (cont.)*	
705.2	0.214
775.2	0.206
791.2	0.198
857.2	0.224
904.2	0.194
CURVE 17*	
460.2	0.189
468.2	0.185
470.2	0.184
471.2	0.182
477.2	0.196
482.2	0.203
551.2	0.169
556.2	0.193
631.2	0.202
649.2	0.199
650.2	0.207
705.2	0.199
775.2	0.189
776.2	0.188
828.2	0.185
845.2	0.172
904.2	0.159

*Not shown on plot

FIGURE AND TABLE NO. 9R RECOMMENDED THERMAL CONDUCTIVITY OF CESIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	In Liquid State			
1	(0.525)‡	(30.3)	-457.9				
2	(1.00)	(57.8)	-456.1	301.9	0.197	11.4	83.5
3	1.18	68.2	-454.3	350	0.200	11.6	170.3
4	1.13	65.3	-452.5	400	0.203	11.7	260.3
5	1.04	60.1	-450.7	500	0.205	11.8	440.3
6	0.935	54.0	-448.9	600	0.205	11.8	620.3
7	0.837	48.4	-447.1	700	0.201	11.6	800.3
8	0.769	44.4	-445.3	800	0.194	11.2	980.3
9	0.720	41.6	-443.5	900	0.185	10.7	1160
10	0.689	39.8	-441.7	1000	0.175	10.1	1340
11	0.666	38.5	-439.9	1100	0.163	9.42	1520
12	0.647	37.4	-438.1	1200	0.150	8.67	1700
13	0.630	36.4	-436.3	1300	0.136	7.86	1880
14	0.615	35.5	-434.5	1400	0.122	7.05	2060
15	0.600	34.7	-432.7	1500	0.108	6.24	2243
16	0.590	34.1	-430.9	1600	0.094	5.43	2420
18	(0.572)	(33.1)	-427.3	1700	0.080	4.62	2600
20	(0.554)	(32.0)	-423.7	1800	0.066	3.81	2780
25	(0.523)	(30.2)	-414.7	1900	0.051	2.95	2960
30	(0.500)	(28.9)	-405.7	2000	(0.029)	(1.68)	3140
35	(0.483)	(27.9)	-396.7	2060	(~0)	(~0)	3248
40	(0.470)	(27.2)	-387.7				
45	(0.457)	(26.4)	-378.7				
50	(0.447)	(25.8)	-369.7				
60	(0.430)	(24.8)	-351.7				
70	(0.420)	(24.3)	-333.7				
80	(0.410)	(23.7)	-315.7				
90	(0.402)	(23.2)	-297.7				
100	(0.397)	(22.9)	-279.7				
150	(0.378)	(21.8)	-189.7				
200	(0.368)	(21.3)	- 99.7				
250	(0.363)	(21.0)	- 9.7				
273.2	(0.361)	(20.9)	32.0				
300	0.359	20.7	80.3				
301.9	0.359	20.7	83.5				

REMARKS

The recommended values are for high-purity cesium with residual electrical resistivity $\rho_0 = 0.0465\ \mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 60 K). The values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

*T_1 in K, k_1 in Watt cm^{-1}K^{-1}, T_2 in F, and k_2 in Btu hr^{-1}ft^{-1}F^{-1}.

‡Values in parentheses are extrapolated, interpolated, or estimated.

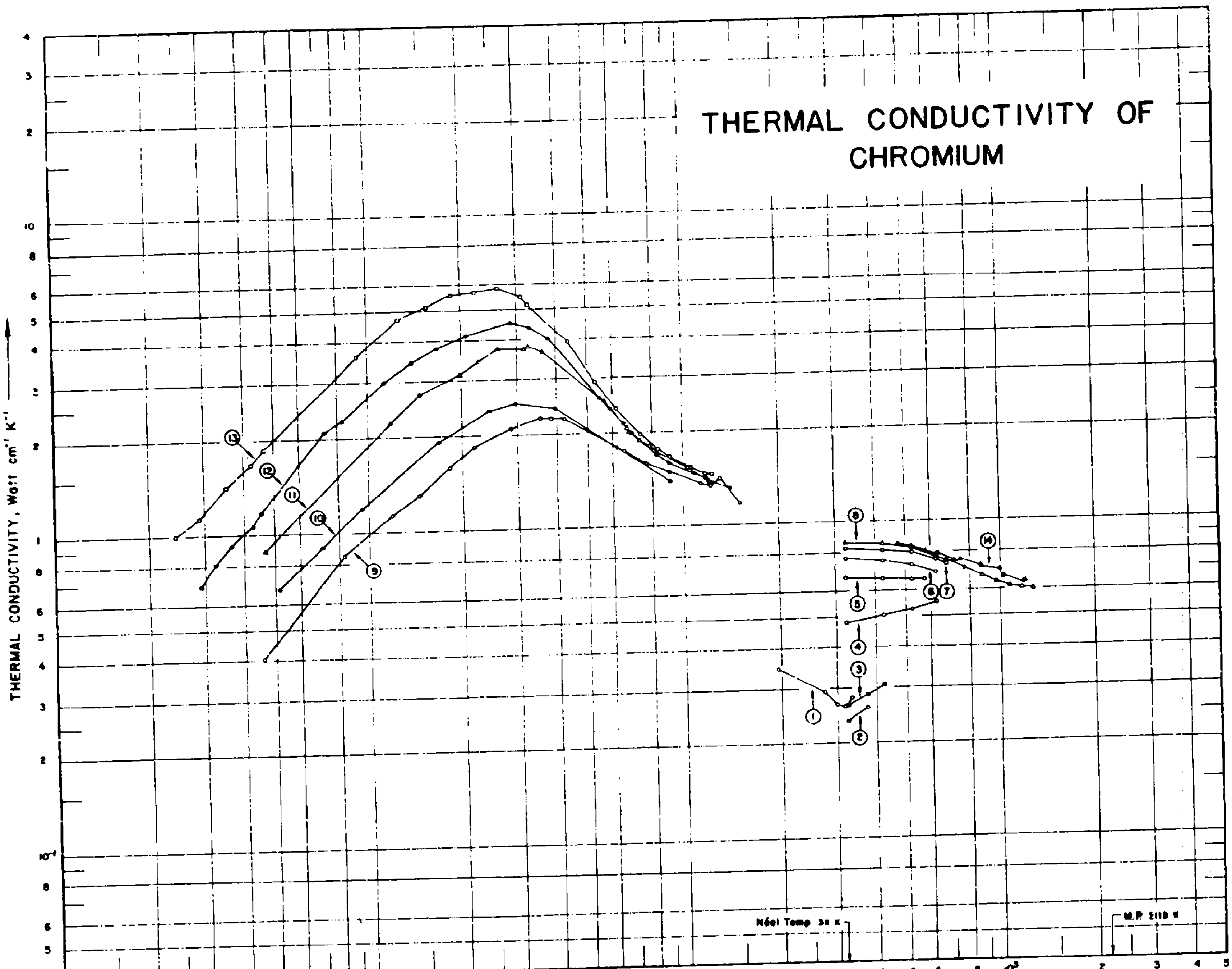

THERMAL CONDUCTIVITY OF CHROMIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Néel Temp 311 K
M.P. 2118 K
1
2
3
4
5
6
7
8
9
10
11
12
13
14

FIG 10

SPECIFICATION TABLE NO. 10 THERMAL CONDUCTIVITY OF CHROMIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 10]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	136	L	1940	196-334		Cr II	Electrolytic; specimen 0.7 x 0.23 x 0.21 cm; annealed at 1000 C for 30 min.
2	112	L, C	1957	323, 373			0.43 O; electrodeposited chromium tube, 1.28 cm O.D., 0.63 cm I.D., and 18.05 cm long; as deposited; density 6.975 g cm^{-3}; electrical resistivity 40.4, 41.7, 44.0, 45.4, 47.2, 48.9, and 50.3 μohm cm at -144, -112, -31, -44, -8, 32, 73 C, respectively.
3	112	L, C	1957	323-423			The above specimen heat treated at 486 K; electrical resistivity 30.3, 39.7, 42.2, 44.6, and 48.2 μohm cm at -172, 26, 95, 148, and 223 C, respectively.
4	112	L, C	1957	323-623			The above specimen heat treated at 478 K, density increased to 7.08 g cm^{-3}; electrical resistivity 6.2, 25.5, 28.9, 33.2, 35.2, 37.8, 39.9, and 47.2 μohm cm at -173, 21, 92, 174, 215, 265, 313, and 399 C, respectively.
5	112	L, C	1957	323-573			The above specimen heat treated at 818 K; electrical resistivity 4.4, 6.9, 10.5, 13.9, 18.1, 19.9, 25.5, 30.1, 37.2, 44.3, 48.8, and 52.2 μohm cm at -176, -140, -103, -58, -1, 31, 161, 220, 331, 434, 503, and 551 C, respectively.
6	112	L, C	1957	323-623			The above specimen heat treated at 1133 K; electrical resistivity 16.1, 21.7, 32.2, 46.0, and 65.7 μohm cm at 22, 162, 355, 570, and 869 C, respectively.
7	112	L, C	1957	323-673			The above specimen heat treated at 1327 K; electrical resistivity 14.3, 16.2, 19.9, 27.0, 30.4, 34.9, 40.5, 46.8, 53.3, 59.5, 71.8, and 77.4 μohm cm at 0, 62, 147, 293, 350, 435, 528, 636, 730, 816, 994, and 1067 C, respectively.
8	112	L, C	1957	323-1273			The above specimen heat treated at 1683 K; density increased to 7.15 g cm^{-3}; electrical resistivity 1.9, 10.5, 13.8, 17.2, 23.7, 30.2, 35.3, 44.7, 55.2, 65.4, 76.6, 81.6, and 95.2 μohm cm at -179, -46, 26, 120, 282, 406, 505, 669, 841, 999, 1167, 1236, and 1427 C, respectively.
9	68	L	1957	4.5-123		1	99.998 pure; specimen 3 mm in dia and 8 cm long; supplied by the Aeronautical Res. Labs. of the Commonwealth Dept. of Supply; cold worked; residual resistivity 0.255 μohm cm.
10	68	L	1957	5.1-91		2	The above specimen annealed at 1010 C for 4 hrs; residual resistivity 0.181 μohm cm.
11	68	L	1957	4.6-151		3	99.998 pure; partially recrystallized; specimen 3 mm in dia and 8 cm long; supplied by the Aeronautical Res. Labs of the Commonwealth Dept. of Supply; residual resistivity 0.125 μohm cm.
12	68	L	1957	2.9-142		4	The above specimen annealed at 1050 C for 4 hrs; residual resistivity 0.090 μohm cm.
13	68	L	1957	2.4-123		5	99.998 pure; fully recrystallized; specimen 3 mm in dia and 8 cm long; supplied by the Aeronautical Res. Labs of the Commonwealth Dept. of Supply; residual resistivity 0.055 μohm cm $\rho(273\ K)/\rho(0\ K) = 217$.
14	89	C	1956	470-1201			Chemically pure; ductile; supplied by the Bureau of Mines, Oregon; density 7.16 g cm^{-3} at 24 C.

DATA TABLE NO. 10 THERMAL CONDUCTIVITY OF CHROMIUM

(Impurity < 0.20% each, total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

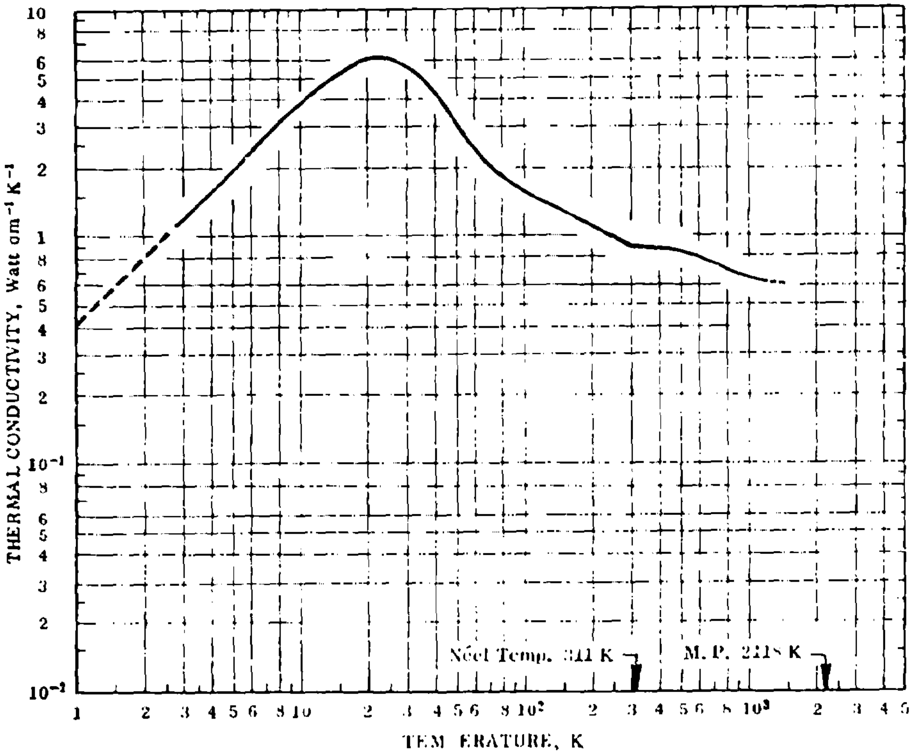
T	k
CURVE 1	
195.6	0.344
273.8	0.292
299.2	0.266
316.7	0.262
334.2	0.279
CURVE 2	
323.2	0.235
373.2	0.269
CURVE 3	
323.2	0.265
373.2	0.285
423.2	0.305
CURVE 4	
323.2	0.480
423.2	0.505
523.2	0.525
623.2	0.550
CURVE	
323.2	0.660
423.2	0.655
523.2	0.650
573.2	0.650
CURVE 6	
323.2	0.765
423.2	0.750
523.2	0.725
623.2	0.685
CURVE 7	
323.2	0.820
423.2	0.810
523.2	0.795
623.2	0.755
673.2	0.730

T	k
CURVE 8	
323.2	0.860
423.2	0.850
523.2	0.825
623.2	0.770
673.2	0.750
773.2	0.705
873.2	0.665
973.2	0.635
1073.2	0.615
1173.2	0.605
1273.2	0.600
CURVE 9	
4.54	0.403
8.27	0.847
11.8	1.13
14.5	1.31
18.2	1.59
21.8	1.84
28.6	2.10
35.5	2.24
38.3	2.24
42.3	2.23
65.1	1.75
76.6	1.59
90.3	1.48
114.3	1.36
122.6	1.35
CURVE 10	
5.14	0.669
7.06	0.903
9.48	1.19
16.7	1.91
24.4	2.38
29.6	2.50
39.6	2.40
61.9	1.80
90.7	1.40

T	k
CURVE 11	
4.64	0.887
11.8	2.22
14.7	2.72
19.8	3.14
22.8	3.41
26.2	3.73
31.8	3.71
32.7	3.79
36.3	3.63
56.6	2.52
66.9	2.07
67.5	2.01
72.9	1.89
78.6	1.82
81.0	1.75
103.2	1.54
121.0	1.39
131.0	1.40
150.8	1.18
CURVE 12	
2.88	0.685
3.23	0.806
3.63	0.927
4.23	1.07
4.54	1.18
7.26	2.10
8.27	2.26
11.3	2.98
13.9	3.41
16.7	3.77
20.8	4.18
28.8	4.53
33.1	4.39
37.9	4.01
54.8	2.59
58.9	2.38
65.1	2.14
69.0	1.99
82.3	1.69
90.7	1.59
108.9	1.47
117.5	1.42
142.1	1.32

T	k
CURVE 13	
2.42	0.992
2.88	1.13
3.53	1.42
4.23	1.66
4.64	1.86
9.27	3.60
12.6	4.72
15.5	5.11
18.7	5.60
22.2	5.69
26.4	5.81
31.2	5.46
32.7	5.17
43.8	3.91
53.0	2.90
61.9	2.38
73.2	1.98
83.1	1.76
90.9	1.66
105.6	1.54
117.5	1.46
123.4	1.45
CURVE 14	
470.4	0.852
524.8	0.839
580.9	0.808
634.3	0.786
638.7	0.787
717.1	0.748
721.5	0.748
750.4	0.756
866.0	0.722
871.5	0.722
872.6	0.711
993.3	0.697
1024.3	0.659
1031.0	0.665
1193.2	0.632
1201.0	0.637

FIGURE AND TABLE NO. 10R RECOMMENDED THERMAL CONDUCTIVITY OF CHROMIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	300	0.903	52.2	80.3
1	(0.401)‡	(23.2)	-457.9	311	0.886	51.2	100.1
2	(0.802)	(46.3)	-456.1	350	0.881	50.9	170.3
3	1.20	69.3	-454.3	400	0.873	50.4	260.3
4	1.60	92.4	-452.5	500	0.848	49.0	440.3
5	1.99	115	-450.7	600	0.805	46.5	620.3
6	2.38	138	-448.9	700	0.757	43.7	800.3
7	2.77	160	-447.1	800	0.713	41.2	980.3
8	3.14	181	-445.3	900	0.678	39.2	1160
9	3.50	202	-443.5	1000	0.653	37.7	1340
10	3.85	222	-441.7	1100	0.636	36.7	1520
11	4.18	242	-434.9	1200	0.624	36.1	1700
12	4.49	259	-438.1	1300	(0.616)	(35.6)	1880
13	4.78	276	-436.3	1400	(0.611)	(35.3)	2060
14	5.04	291	-434.5				
15	5.27	305	-432.7				
16	5.48	317	-430.9				
18	5.81	336	-427.3				
20	6.01	347	-423.7				
25	6.07	351	-414.7				
30	5.58	322	-405.7				
35	5.03	291	-396.7				
40	4.30	248	-387.7				
45	3.67	212	-378.7				
50	3.17	183	-369.7				
60	2.48	143	-351.7				
70	2.08	120	-333.7				
80	1.82	105	-315.7				
90	1.68	97.1	-279.7				
100	1.58	91.3	-279.3				
150	1.29	74.5	-189.7				
200	1.11	64.1	- 99.7				
250	0.992	57.3	- 9.7				
273.2	0.946	54.8	32.0				

REMARKS

The recommended values are for well-annealed 99.998⁺% pure chromium with residual electrical resistivity ρ_0 = 0.0609 $\mu\Omega$ cm (characterization by ρ_0 becomes important below room temperature). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, α' = 1.04 x 10^{-4}, and β = 2.49. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature, and 3 to 10% at other temperatures.

* T_1 in K, k_1 in Watt $cm^{-1}K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1}ft^{-1}F^{-1}$.

‡ Values in parentheses are extrapolated.

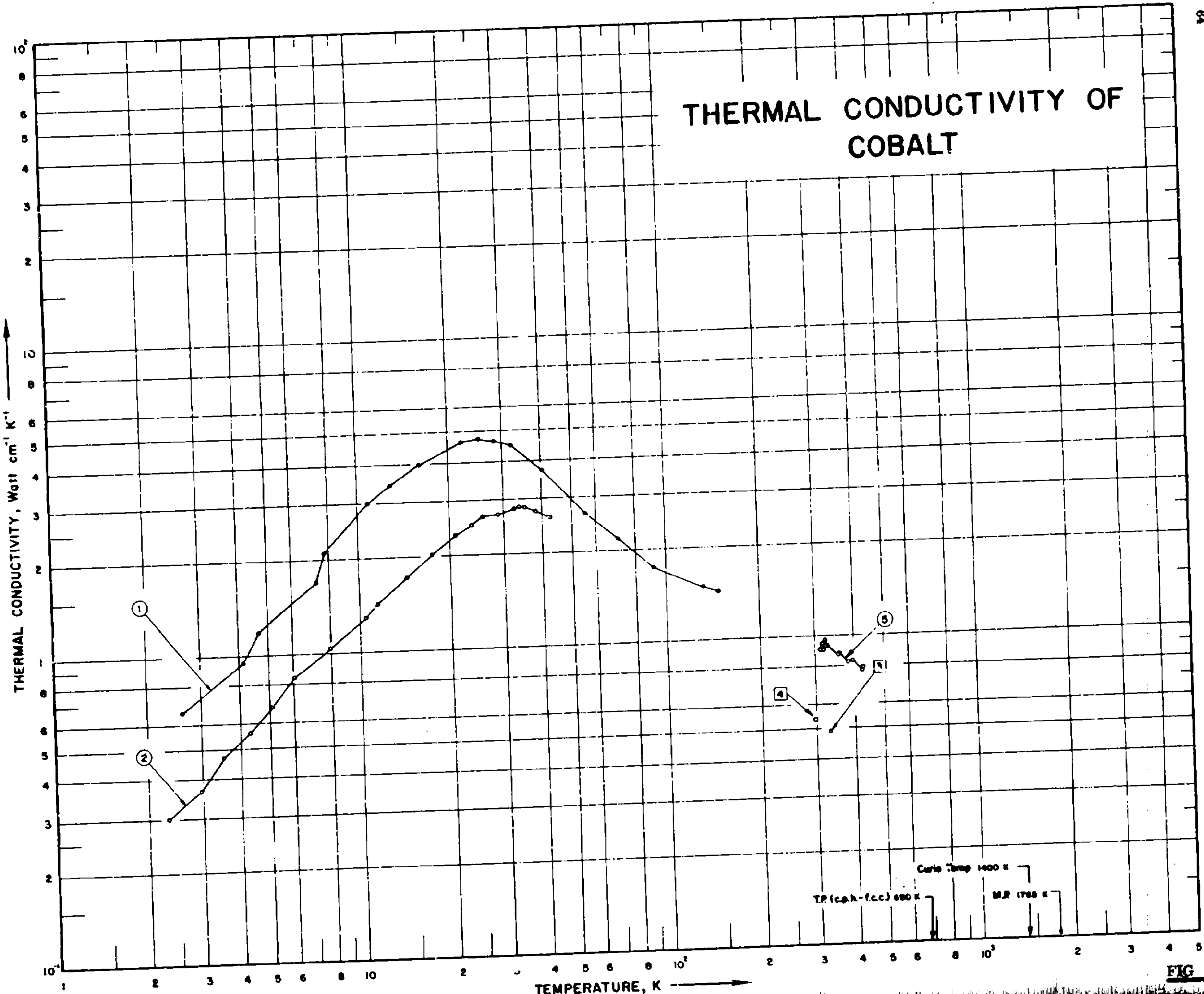

THERMAL CONDUCTIVITY OF COBALT
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Curie Temp 1400 K
T.P. (c.p.h.-f.c.c.) 690 K
M.P. 1768 K

FIG 11

SPECIFICATION TABLE NO. 11 THERMAL CONDUCTIVITY OF COBALT

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 11]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	150	L	1957	2.6-147		Co 1b	Impurities (by spectrographic analysis) approx. 0.0002 Si, < 0.0005 Fe, approx. 0.0001 Al, Mg and Cu 0.0001 each; specimen 2 mm dia; supplied by Johnson, Matthey and Co., Ltd. (J M9484xx); annealed in vacuum for 2 hrs at 700 C; ρ_0 = 0.09075 μ ohm cm; $\rho(295\ K)/\rho_0$ = 64.5, L_0 = 2.55 x 10^{-8} W ohm K^{-2}.
2	122	L	1955	2.3-43	3.0	Co 1	Polycrystalline rod; 3.03 cm long, 0.204 cm in dia; supplied by Johnson, Matthey and Co., Ltd.; annealed in vacuo for several hrs; electrical resistivity ratio $\rho(293\ K)/\rho(20\ K)$ = 29.4
3	230	L	1925	332.2			Less than 0.03 impurities; supplied by Eimer and Amend; annealed at 900 C for 2 to 3 hrs before machining to size.
4	1057 ~~647~~		1959	298.2			100 (Nominal) pure; measured at room temp. (assumed to be 25 C)
5	869	C	1964	313-430			99.97 pure; 0.951 cm dia, 4.346 cm long; supplied by Metallurgy Division of the National Physical Laboratory; Armco iron used as reference; electrical resistivity reported as 6.5, 6.7, 7.4, 7.7, 8.7, 8.9, 10.3, 11.4, and 11.6 μohm cm at 20, 22, 51, 55, 82, 87, 126, 151, and 155 C, respectively.

DATA TABLE NO. 11 THERMAL CONDUCTIVITY OF COBALT

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

CURVE 1

T	k
2.59	0.657
4.14	0.947
4.66	1.187
7.24	1.692
7.76	2.096
10.86	3.005
12.93	3.434
16.03	3.990
22.24	4.672
25.34	4.722
28.45	4.646
32.07	4.495
40.34	3.737
55.34	2.652
70.34	2.172
91.03	1.742
132.90	1.490
147.40	1.439

CURVE 2

T	k
2.30	0.300
2.95	0.365
3.53	0.470
4.30	0.560
5.10	0.675
6.02	0.840
7.97	1.035
10.05	1.270
11.50	1.420
14.40	1.710
17.40	2.020
20.92	2.335
23.53	2.500
25.82	2.660
28.75	2.690
32.55	2.800
33.75	2.840
35.40	2.825
38.30	2.740
42.60	2.600

CURVE 3

T	k
332.2	0.490

CURVE 4

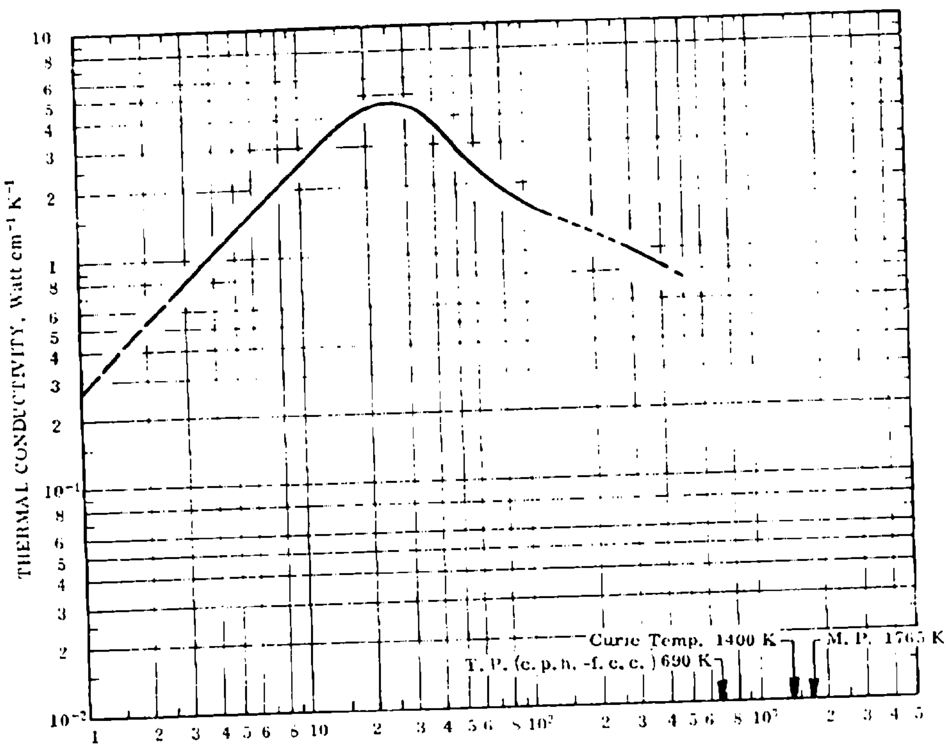
T	k
298.2	0.536

CURVE 5

T	k
313.2	0.902
316.5	0.943
320.2	0.908
323.2	0.909*
324.2	0.930
324.2	0.970
327.2	0.930
356.2	0.872
360.2	0.881
384.2	0.825
397.2	0.837
424.2	0.775
430.2	0.793

* Not shown on plot

FIGURE AND TABLE NO. 11R RECOMMENDED THERMAL CONDUCTIVITY OF COBALT



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.270)‡	(15.6)	-457.9
2	(0.539)	(31.1)	-456.1
3	0.808	46.7	-454.3
4	1.08	62.4	-452.5
5	1.34	77.4	-450.7
6	1.61	93.0	-448.9
7	1.87	108	-447.1
8	2.13	123	-445.3
9	2.38	138	-443.5
10	2.63	152	-441.7
11	2.87	166	-439.9
12	3.10	179	-438.1
13	3.31	191	-436.3
14	3.52	203	-434.5
15	3.71	214	-432.7
16	3.89	225	-430.9
18	4.19	242	-427.3
20	4.43	256	-423.7
25	4.70	272	-414.7
30	4.58	265	-405.7
35	4.23	244	-396.7
40	3.77	218	-387.7
45	3.32	192	-378.7
50	2.98	172	-369.7
60	2.48	143	-351.7
70	2.16	125	-333.7
80	1.94	112	-315.7
90	1.78	103	-297.7
100	1.68	97.1	-279.7
150	(1.39)	(80.3)	-189.7
200	(1.22)	(70.5)	- 99.7
250	(1.09)	(63.0)	- 9.7
273.2	(1.04)	(60.1)	32.0
300	0.992	57.3	80.3
350	0.916	52.9	170.3
400	0.848	49.0	260.3
500	(0.746)	(43.1)	440.3

REMARKS

The recommended values are for well-annealed 99.999% pure cobalt with residual electrical resistivity ρ_0 = 0.0905 $\mu\Omega$ cm (characterization by ρ_0 becomes important below room temperature). The values below 1.5 Tm are calculated to fit the experimental data by using n = 2.10, α' = 0.747 x 10^{-4}, and β = 3.71. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures.

* T_1 in K, k_1 in Watt $cm^{-1} K^{-1}$, T_2 in F, and k_2 in Btu $lb^{-1} ft^{-1} F^{-1}$.

‡ Values in parentheses are extrapolated or interpolated.

FIGURE SHOWS ONLY 69 OF THE CURVES REPORTED IN TABLE

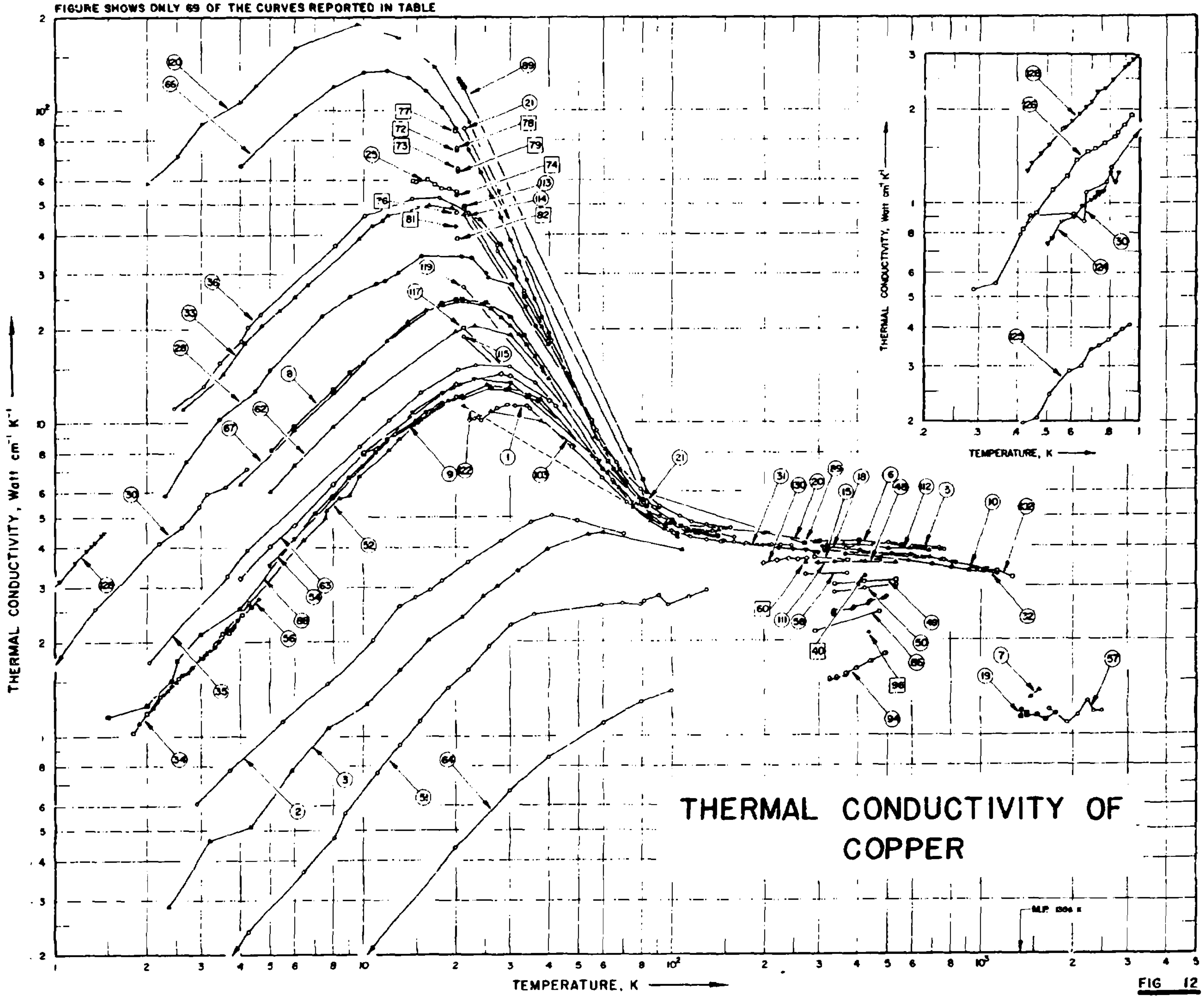


FIG 12

SPECIFICATION TABLE NO. 12 THERMAL CONDUCTIVITY OF COPPER

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 12]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	114	L	1950	23-245	0.6-1.8	OFHC Cu	Free from oxygen; high conductivity; specimen 0.5 in. in dia and 20 in. long; obtained from American Brass Co.
2	154	L	1956	2.9-70	5	1	0.20 Ni, 0.10 O; 0.05 each of As, Sb, Fe, Pb, and Sn, 0.01 S, 0.003 Bi (composition according to All-Union standard); annealed to 800 C.
3	154	L	1956	2.4-108	5	2	Similar to the above specimen except unannealed.
4	135	L	1935	293,473			99.986 pure; 0.022 O, 0.0016 Fe, 0.0015 S; annealed at 550 C for 1 hr.
5	124	P	1930	368-766		1	Electrolytically pure; specimen ~0.25 cm in dia; annealed for about 10 min at a bright red heat; electrical conductivity 4.47, 3.14, 2.07 and 1.99 x 10^5 ohm^{-1} cm^{-1} at 95, 235, 466 and 497 C, respectively; density 8.87 g cm^{-3}.
6	124	P	1930	302-744		2	Electrolytically pure; specimen ~0.25 cm in dia; annealed for about 10 min at a bright red heat; electrical conductivity 5.55, 4.0, 2.84 and 2.06 x 10^5 ohm^{-1} cm^{-1} at 29, 136, 286 and 471 C, respectively, density 8.87 g cm^{-3}.
7	90	L	1957	1456,1550			0.036 O, 0.02 Ag, 0.002 Al, 0.002 Fe, 0.001 Ni, 0.001 Mg, 0.001 Si, 0.0005 Ca, traces of H and N; electrolytic tough-pitch copper; in molten state.
8	109	L	1957	5.1-142	2-5	Coalesced Copper	High-purity commercial coalesced copper; 0.0013 O, 0.0008 Pb, 0.0007 Ni, < 0.0005 each of Fe, As, and Sb, 0.0002 Sn, < 0.0001 Te, and Ag, < 0.00005 Bi; specimen 0.367 cm in dia and 23.2 cm long; annealed in helium 4 hrs at 400 C, cooled slowly to 200 C, and then kept in helium at 200 C for 8 hrs; density 8.90 g cm^{-3}.
9	152	L	1949	10-20			Electrical copper; specimen 0.47 mm in dia and 900 mm long; annealed.
10	108	E	1958	315-1058	3		Commercial electrolytic copper.
11	84	P	1918	349-636			Specimen drawn wire 2.5 mm in dia.
12	95	E	1915	21-374		Cu I	Electrolytically pure; specimen 1 mm in dia; supplied by Siemens and Halske Co.
13	95	E	1915	22-375		Cu II	Electrolytically pure but purity lower than the above specimen.
14	52	L	1952	339-533	5	A	Oxygen-free (< 0.01 O) high-conductivity copper.
15	77	E	1900	291,373		Cu II	< 0.05 (Fe+Zn); specimen 1.108 cm in dia and 27 cm long; density 8.65 g cm^{-3} at 18 C.
16	77	E	1900	291,373		Cu IIW	< 0.05 (Fe+Zn); specimen 1.107 cm in dia and 27 cm long.
17	77	E	1900	29',373		Cu III	0.05 Pb, traces of Ni and Fe; specimen 1.107 cm in dia and 27 cm long; drawn; density 8.88 g cm^{-3} at 18 C.
18	130	P	1951	309-834			Specimen 0.125 in. in dia and at least 50 cm long.
19	41	C	1956	1362-1761	± 2		Electrolytic tough pitch copper; before measurement: 0.012 O_2, 0.0048 N_2, and trace Al, Ca, Mg, Ni, Si and Ti; after measurement: 0.0059 O_2, 0.0055 N_2 and all the metallic impurities reduced about ten fold; density 8.83 g cm^{-3}; in molten state.

SPECIFICATION TABLE NO. 12 (continued)

Curve No.	Ref. No.	Method Used*	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
20	80	L	1928	95-293			Single crystal; specimen 0.6 cm in dia and 12 cm long; supplied by General Electric Co.
21	57	L	1927	21, 83		Cu 2b	Very high purity; porous natural crystal from Lake Superior, hammered from 3 mm to 1.3 mm and then annealed 3 hrs at 380 C; electrical resistivity 1.562, 0.235 and 0.00187 μohm cm at 273, 83 and 21 K, respectively.
22	57	L	1927	21, 83		Cu 3	"Purest" electrolytic copper; fine grains; electrical resistivity 1.552, 0.239 and 0.00424 μohm cm at 273, 83 and 21 K, respectively.
23	57	L	1927	21, 83		Cu 4a	"Purest" electrolytic copper; with fine grains; annealed 4.5 hrs at 380 C; electrical resistivity 1.56, 0.240, 0.00406 μohm cm at 273, 83 and 21 K, respectively.
24	57	L	1927	21, 83		Cu 6a	Not very pure; single crystal; annealed 7.5 hrs at 380 C; electrical resistivity 1.58, 0.249, 0.01356 μohm cm at 273, 83 and 21 K, respectively.
25	18	L	1936	15-20			Specimen 0.2 mm in dia.
26	58	L	1934	22, 79		Cu 2b	Very high purity; probably somewhat deformed.
27	127	L	1925	369-898			99.9 pure; supplied by Bolton and Sons, Ltd., Oakmoor; density 8.92 g cm^{-3} at 21 C; electrical resistivity 1.69, 2.60, 3.73, 4.88, and 6.03 μohm cm at 14.0, 144.8, 306.0, 470.0, and 630.2 C, respectively.
28	97, 122	L	1952	2.5-41	2-3	Cu 1	99.999 pure; polycrystalline; JM 4234 from Johnson, Matthey and Co.; 3.02 mm dia and 2.99 cm long; annealed for several hrs in vacuo at 800 C; $\rho(293\ K)/\rho(20\ K)$ = 85.3.
29	23	E	1894	347-440			Electrolytic copper; specimen a prismatic bar with 5 cm x 2 cm cross section.
30	103	L	1953	0.29-4.2			Polycrystalline; commercial grade high purity magnet wire; specimen 0.025 cm in dia and 27.2 cm long; supplied by General Electric Co.
31	88	L	1908	107-299			Turned from soft-drawn high-conductivity copper conductor; specimen 0.585 cm in dia and 7-8 cm long; electrical resistivity 0.375, 0.543, 0.637, 0.939, 0.989, 1.365, 1.506, and 1.750 μohm cm at -176.8, -151.2, -136.9, -102.0, -91.1, -36.0, -15.5, and 16.9 C, respectively; density 8.84 g cm^{-3} at 23 C.
32	89	C	1956	367-1144			99.9+ pure; electrolytic tough pitch copper; density 8.92 g cm^{-3} at 24 C.
33	11	L	1952	2.6-91			99.999 pure; about 0.0005 Ag, < 0.0003 Ni, < 0.0004 Pb; JM 4234 from Johnson, Matthey and Co.; drawn and annealed in a helium atmosphere at 450 C for 6 hrs; electrical resistivity for the range 12-15 K given as $\rho = 5.27 \times 10^{-3} + 2.64 \times 10^{-10} T^5$ (μohm cm).
34	2	L	1948	1.8-4.1	2		0.003 Ag, 0.003 Ni, 0.003 Pb; approximate composition; free from oxygen; Johnson Matthey and Co. Ltd. No. 1562; annealed in air; $\rho_0 = 0.055$ μΩ cm.
35	145	L	1953	2.0-160	1, but up to 4 between 5 and 15 K	Cu 1	99.999 pure; JM 4272 from Johnson, Matthey and Co.; about 0.0005 Ag, 0.0004 Pb, and < 0.0003 Ni, and barely visible spectral lines of Ga and Fe; specimen 2 mm in dia rod; as drawn; electrical resistivity for the range 10 to 35 K given as $\rho = 0.0576 \times 10^{-6} + 3.7 \times 10^{-16} T^5$ (ohm cm).

SPECIFICATION TABLE NO. 12 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
36	145	L	1953	2.5-155	4	Cu2	The above specimen annealed in vacuo at 550 C for 3 hrs.
37	116	F	1895	219-260			Electrolytic copper.
38	186	P	1928	305.2			Electrolytically pure; specimen 2.5 mm in dia and 4.69 cm long; electrical conductivity 5.58×10^5 mho cm^{-1} at 32 C; density 8.93 g cm^{-3} at 32 C.
39	224	L	1923	423.2			99.98 pure; annealed.
40	224	L	1923	428.2			99.98 pure; cast.
41	224	L	1923	423.2			99.97 pure; hard-drawn.
42	224	L	1923	430.2			99.76 pure; cast.
43	270	P	1915	308,333			specimen 0.25 cm in dia and 30 cm long; density 8.93 g cm^{-3} at room temperature (from Tabellen of Landolt and Bornstein).
44	271	L	1938	273-403	0.11		≤ 0.079 O.
45	271	L	1938	273-403	0.11		≤ 0.079 O, 0.106 Ni.
46	271	L	1938	273-403	0.11		≤ 0.022 O.
47	271	L	1938	273-403	0.11		≤ 0.022 O, 0.106 Ni.
48	52	L	1952	339-533	5	B	0.015 Fe, 0.011 P; cast.
49	52	L	1952	339-533	5	C	0.061 Fe, 0.016 P; cast.
50	52	L	1952	339-533	5	D	0.089 Fe, 0.015 P; cast.
51	341	L	1954	1.9-130			0.056 Fe; nominal composition; homogenized and annealed; residual electrical resistivity (at helium temp) 0.56 μ ohm cm.
52	341	L	1954	1.9-142			0.0043 Fe; nominal composition; homogenized and annealed; residual electrical resistivity (at helium temp) 0.041 μ ohm cm.
53	225	L	1926	373.2			Electrolytic.
54	145	L	1953	5.0-58	< 4	Cu 3	99.999 pure; JM 4272 from Johnson, Matthey and Co.; about 0.0005 Ag, 0.0004 Pb, < 0.0003 Ni, and barely visible spectral lines of Ga and Fe; specimen 1 mm in dia rod; as drawn.
55	427	L	1960	303.2	1-3	ETP	Electrolytic tough pitch copper; specimen 0.75 in. in dia and 9 in. long.
56	404	L	1950	2.5-4.6	4		99.998⁺ pure; polycrystal; supplied by Johnson, Matthey and Co.
57	428	R	1957	1673-2500	± 10		In liquid state.
58	246	T	1919	273,373			Rolled, drawn, and then heated 0.5 hr at temp close to melting point.
59	429	R	1937	285.7	± 0.7		Pure.

SPECIFICATION TABLE NO. 12 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
60	430	T	1924	273.2			Pure; rolled and drawn to wire of 1 mm^2 cross section and 3 cm long, and heated at temp close to melting point.
61	431	E	1944	597-1245			Polycrystal.
62	432	L	1957	5.0-40		Coalesced Cu	99.98 pure; 0.0013 O_2, 0.0007 Ni, 0.0008 Pb, 0.0002 Sn, each of Fe, As, Sb < 0.0005, 0.0001 Te, and Bi < 0.00005; cold rolled, annealed for 1 hr at 650 C, redrawn and reannealed for 17 min at 760 C, followed by grinding to sample size of 0.144 in. in dia; density 8.899 g cm^{-3}; porosity 0.5%.
63	432	L	1957	4.0-40		Electrolytic tough pitch	0.01 Fe, 0.001 each Ag and Zn, each of Al, Cr, Pb, Mg, Mn, and Sn < 0.0001; electrolytic tough pitch; density 8.914 g cm^{-3}; ground.
64	432	L	1957	5.0-100		Phosphorus deoxidized Cu	0.027 P, 0.01 each of Fe, Ag, and Zn, 0.001 each Ni and Si, < 0.0001 each of Al, Cr, Pb, Mg, and Mn; density 8.917 g cm^{-3}; ground.
65	433	L	1940	78.2		Electrolytic Cu	0.015 Sb, 0.010 Fe, 0.007 S, trace Pb.
66	434	L	1959	4.0-105			99.999 pure; swaged from about 0.375 in. down to about 0.072 in., cleaned with a 1:1 solution of HCL and a 1:10 solution of HNO_3, annealed in vacuum for 2 hrs at 400 C, drawn through tungsten carbide dies to 0.070 in., cleaned with acids, and finally annealed again in vacuum for 2 hrs at 400 C; slight unavoidable work hardening of the sample during installation in the apparatus.
67	434	L	1959	4.0-105			99.999 pure; swaged from about 0.375 in. down to about 0.0816 in., cleaned with acids, annealed in vacuum for 2 hrs at 400 C, and then drawn through tungsten carbide dies to 0.070 in. in which the cross-section area reduced by 26.4%; not annealed again after drawing.
68	435	L	1900	291.2			Pure.
69	435	L	1900	291.2			Trace As.
70	410	R	1935	273.2	1		Pure; electrical conductivity 62.8 x 10^4 mho cm^{-1} at 273.2 K.
71	436	L	1938	21.17		Cu 12	Natural single crystal; tempered for 3 hrs at 380 C; measured at H (the transverse magnetic field strength) = 0 and θ (the angle between magnetic field direction and a line perpendicular to rod axis) = 0° at which the electrical resistivity is nearly minimum and H nearly parallel to [100] direction.
72	436	L	1938	21.17		Cu 12	The above specimen measured at H = 2280 oersteds and θ = 0°.
73	436	L	1938	21.18		Cu 12	The above specimen measured at H = 4490 oersteds and θ = 0°.
74	436	L	1938	21.21		Cu 12	The above specimen measured at H = 8750 oersteds and θ = 0°.
75	436	L	1938	21.23		Cu 12	The above specimen measured at H = 10880 oersteds and θ = 0°.
76	436	L	1938	21.25		Cu 12	The above specimen measured at H = 12200 oersteds and θ = 0°.

SPECIFICATION TABLE NO. 12 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
77	436	L	1938	21.17		Cu 12	The above specimen measured at H = 0 oersteds and $\theta = -40^{\circ}$ at which the electrical resistivity is nearly maximum and H nearly parallel to [110] direction.
78	436	L	1938	21.18		Cu 12	The above specimen measured at H = 2280 oersteds and $\theta = -40^{\circ}$.
79	436	L	1938	21.19		Cu 12	The above specimen measured at H = 4490 oersteds and $\theta = -40^{\circ}$.
80	436	L	1938	21.24		Cu 12	The above specimen measured at H = 8750 oersteds and $\theta = -40^{\circ}$.
81	436	L	1938	21.24		Cu 12	The above specimen measured at H = 10800 oersteds and $\theta = -40^{\circ}$.
82	436	L	1938	21.30		Cu 12	The above specimen measured at H = 12200 oersteds and $\theta = -40^{\circ}$.
83	437	E	1902	291.2			Pure.
84	390	P	1956	354.2			Pure.
85	438	E	1914	21-373			Electrolytic copper wire; not annealed and not bent, but heated considerably during soldering.
86	135	L	1935	293,473		Bar 104	99.80 Cu, 0.19 Si, and 0.02 Fe; specimen 0.75 in. in dia and 8 in. long; electrical conductivity 29.58 and 21.30 x 10^4 mho cm^{-1} at 20 and 200 C, respectively; annealed at 700 C for 2 hrs.
87	439	L	1935	323-848	2		99.9 pure.
88	355	L	1955	1.5-142	1		99.98 pure; 0.02 Ge; specimen 1 ~ 2 mm in dia and 6 cm long; drawn; and annealed; electrical resistivity 1.92 μ ohm cm at 295 K.
89	619	L	1916	20-273			High purity single crystal natural copper.
90	619	L	1916	22-273			Commercially pure; fine crystalline.
91	440	L, R	1940	78,273		Electrolytic Cu	Impurities: 0.015 Sb, 0.010 Fe, 0.007 S, 0.0003 As; annealed in nitrogen stream for 20 hrs at 380-400 C; electrical conductivity 6.22 and 43.1 x 10^5 mho cm^{-1} at 273 and 78 K, respectively.
92	134	L	1931	337-477	< 2	93	99.94 pure; 0.042 P, 0.04 Fe; annealed at 650 C for 1 hr and cooled in air.
93	134	L	1931	337-494	< 2	82	99.97 pure; 0.075 P, 0.04 Fe; annealed at 650 C for 1 hr and cooled in air.
94	134	L	1931	325-496	< 2	95	99.74 pure; 0.18 P; annealed at 650 C for 1 hr and cooled in air.
95	67	L	1932	438			99.917 pure; 0.083 P; specimen 0.5 in. in dia and 6.5 in. long; annealed.
96	67	L	1932	438			99.865 pure; 0.135 P; specimen 0.5 in. in dia and 6.5 in. long; annealed.
97	67	L	1932	438			99.93 pure; 0.07 As; specimen 0.5 in. in dia and 6.5 in. long; annealed.
98	67	L	1932	438			99.856 pure; 0.144 As; specimen 0.5 in. in dia and 6.5 in. long; annealed.
99	230	L	1925	332.2			Impurity < 0.03; electrical conductivity 50.8 x 10^4 mho cm^{-1} at 296.2 K.

SPECIFICATION TABLE NO. 12 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
100	135	L	1935	293, 473		Bar 114	0.07 Mn, 0.01 Fe, 0.02 Mg; specimen 0.75 in. in dia and 8 in. long; electrical conductivity 52.55 and 32.18 x 10^4 mho cm^{-1} at 20 and 200 C, respectively; annealed at 700 C for 2 hrs.
101	135	L	1935	293, 473		Bar 115	0.14 Mn, 0.01 Fe, 0.01 Mg; specimen 0.75 in. in dia and 8 in. long; electrical conductivity 45.79 and 29.4 x 10^4 mho cm^{-1} at 20 and 200 C, respectively; annealed at 700 C for 2 hrs.
102	40	L	1956	764-1287	5	Electrolytic tough pitch	Electrolytic tough pitch copper meeting Federal Specification QQC 576 (minimum 99.9 Cu); density 8.83 g cm^{-3}; specimen 7 in. in dia and 1.5 in. thick.
103	562	L	1949	23-245		OFHC	Oxygen-free high conducting (OFHC) copper.
104	496	C	1940	80, 273	< 1		Pure.
105	504	P	1961	295.2	± 5	OFHC	specimen 1.9 cm^2 in cross-sectional area and 0.312 cm thick.
106	622	P	1960	363.2			Commercial grade; 99.82 pure; density 8.3 g cm^{-3}.
107	622	P	1960	363.2			The above specimen, second run.
108	622	P	1960	363.2			The above specimen, third run.
109	622	P	1960	363.2			The above specimen, fourth run.
110	579	L	1936	15-20			"Very pure".
111	135	L	1935	293, 473		Bar No. 99	0.07 Al and 0.01 Fe; annealed at 750 C for 2 hrs; electrical conductivity 52.58 and 31.69 x 10^4 mho cm^{-1} at 20 and 200 C, respectively.
112	620		1956	320-773	< 3		99.99 pure; polycrystalline; electrical resistivity 1.92, 2.50, 3.17, 3.81, 4.43 and 5.03 μohm cm at 46.9, 134.5, 232.2, 323.3, 411.1 and 499.3 C, respectively.
113	57	L	1927	21, 83		Cu 4	"Purest" electrolyte; with fine grains.
114	57	L	1927	21, 83		Cu 4b	The above specimen hammered, then annealed for 4.5 hrs at 380 C, and recrystallized at 950 C for 5 min.
115	57	L	1927	21, 83		Cu 6	Not very pure; single crystal; sawed from larger block and lathed into rod.
116	57	L	1927	21, 83		Cu 6b	From the same block as the above specimen Cu6; hammered from 6 mm to 2.5 mm dia and annealed for 3 hrs at 380 C.
117	57	L	1927	21, 83		Cu 6c	Similar to the above specimen Cu6b except further annealed in vacuum for 5 min at 950 C; about 25 grain cross-sections per 1 mm^2.
118	57	L	1927	21, 83		Cu 7	Lathed from the same block as specimen 6; 3 to 4 crystal grains on the measuring length; unannealed.
119	57	L	1927	21, 83		Cu 7a	Similar to the above specimen Cu7 except annealed for 4 hrs at 380 C.

SPECIFICATION TABLE NO. 12 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
120	623	L	1960	2.0-55			99.999 pure copper from the Central Research Lab. of the American Smelting and Refining Co.; less than 0.0001 each of Fe, Sb, Se, and less than 0.0002 each of Te and As; 0.030 in. dia wire, rolled and drawn from a 0.75 in. dia rod then annealed at 530 C in vacuo for some hrs; residual electrical resistivity 0.865 ± 0.01 x 10^{-8} ohm cm.
121	57	L	1927	21,83		Cu 2a	Very high purity; porous natural crystal hammered from 3 mm to 1.3 mm dia.
122	57	L	1927	21,83		Cu 9	Not very pure; single crystal solidified from melt; completely undeformed and unworked.
123	‡	P	1968	298.2		No. 1	Disk specimen 1.25 cm in diameter and 0.042 cm thick; obtained from DuPont Detaclad stock; thermal conductivity value calculated from the measurement of thermal diffusivity with density value taken from Lyman, T. (editor, "Metals Handbook", 8th ed., Vol. 1, 1961) and specific heat capacity value taken from Kelley, K.K. (U.S. Bureau of Mines Bulletin 584, 1960).
124	683		1963	0.50-0.88		Cu 1	Commercial, polycrystalline wire.
125	683		1963	0.42-0.93		Cu 2	99.999 pure, polycrystalline wire.
126	683		1963	0.42-0.94		Cu 3	99.999 pure, polycrystalline wire; annealed at 898.2 K for 3 hrs.
127	706	L	1881	273,373			Density 8.82 g cm^{-3}; electrical conductivity 45.74 and 33.82 x 10^4 $ohm^{-1}cm^{-1}$ (the author reported 45.74 and 33.82 x 10^5, probably a typographical error) at 0 and 100 C, respectively.
128	880	L	1965	0.4-1.5	± 1		Specimen a foil of 0.05 mm thickness, supplied by Chase Brass and Copper Co.; annealed at 530 C for three hrs; residual resistance ratio 270.
129	851	L	1960	80~217	10		Commercial copper; specimen 0.375 in. in dia and 2.975 in. long; cylinder with a part of 1.1 in. long at one end turned down to a dia of 0.125 in.; data corrected for drift rate.
130	851	L	1960	199~275	10		Similar to the above specimen.
131	843	-	1966	298.2			Nearly spherical grains supplied by Belmont Smelting and Refining Co.; mesh size -30 +35; specimen contained in a 0.75 in. dia and 2 in. long cylindrical cell; thermal conductivity measured by using the transient line source method, the heat source was a 36-gauge constantan wire contained in a 0.025 in. O.D. hypodermic tube soldered along the axis of the cylindrical cell, data calculated from measured line temperatures at two certain times; measured in Freon-12 under a pressure of ~100 psig.
132	843	-	1966	298.2			Similar to the above specimen; measured in argon under a pressure of ~100 psig.
133	843	-	1966	298.2			Similar to the above specimen; measured in nitrogen under a pressure of ~100 psig.
134	843	-	1966	298.2			Similar to the above specimen; measured in methane under a pressure of ~100 psig.
135	843	-	1966	298.2			Similar to the above specimen; measured in helium under a pressure of ~100 psig.

‡Larson, K.B. and Koyama, K., J. Appl. Phys., 39 (9), 4408-16, 1968.

SPECIFICATION TABLE NO. 12 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
136	843	-	1966	298.2			Similar to the above specimen; measured in hydrogen under a pressure of ~100 psig.
137	1005	E	1927	273.2			Specimen No. 10 gauge commercial wire 10 cm in length electrical resistivity 1.73 μ ohm cm at 0 C.
138	1005	E	1927	273.2			The above specimen measured in a longitudinal magnetic field of 10000 gausses.

DATA TABLE NO. 12 THERMAL CONDUCTIVITY OF COPPER

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
22.9	10.2
23.7	10.3
24.1	10.1
27.1	11.2
29.4	11.4
31.1	11.2
34.0	11.3
34.6	11.1
47.5	8.34
59.7	6.64
71.7	5.53
85.6	4.90
99.8	4.49
115.1	4.30
130.1	4.20
145.2	4.15
159.6	4.12
175.5	4.03
211.8	4.05
226.6	4.05
245.2	4.04
CURVE 2	
2.90	0.607
3.72	0.774
5.50	1.11
7.70	1.46
10.8	2.00
13.2	2.59
14.8	2.78
16.5	2.93
18.0	3.13
22.0	3.57
28.0	4.18
35.0	4.81
41.0	5.02
49.5	4.85
70.0	4.39
CURVE 3	
2.37	0.285
3.20	0.460

T	k
CURVE 3 (cont.)	
4.32	0.510
5.90	0.775
7.70	1.06
10.4	1.25
13.2	1.63
16.4	2.00
21.0	2.38
24.5	2.78
27.2	3.01
31.8	3.34
39.5	3.91
53.6	4.39
60.0	4.43
108.0	3.91
CURVE 4*	
293.2	3.93
473.2	3.90
CURVE 5	
368.2	3.93
508.2	4.10
739.2	3.93
766.2	3.89
CURVE 6	
302.2	4.14
409.2	4.18
559.2	3.97
744.2	3.89
CURVE 7	
1456	1.31
1550	1.36
CURVE 8	
5.05	8.16
6.00	9.80
8.00	12.8

T	k
CURVE 5 (cont.)	
9.08	14.5
14.0	20.7
18.0	24.2
20.0	24.8
21.0	24.9
25.0	24.2
30.0	21.9
33.2	19.1
62.0	7.50
80.0	5.64
100.0	4.82
120.0	4.43
142.0	4.31
CURVE 9	
10.0	7.95
15.0	10.0
20.0	12.1
CURVE 10	
314.7	3.87
623.7	3.66
813.5	3.54
1058.4	3.35
CURVE 11*	
349.2	3.82
357.2	3.83
635.2	3.75
636.2	3.69
CURVE 12*	
20.7	17.6
90.7	4.93
273.1	3.92
291.2	3.90
293.7	3.90
374.7	3.90

T	k
CURVE 13*	
21.5	16.9
91.4	4.62
273.1	3.85
291.2	3.83
298.3	3.83
374.6	3.83
CURVE 14*	
338.7	3.80
422.1	3.77
533.2	3.66
CURVE 15	
291.2	3.68
373.2	3.60
CURVE 16*	
291.2	3.73
373.2	3.67
CURVE 17*	
291.2	3.84
373.2	3.80
CURVE 18	
309.2	3.98
409.2	3.86
519.2	3.77
596.2	3.74
687.2	3.67
749.2	3.58
834.2	3.51

T	k
CURVE 19	
1362	1.12
1373	1.18
1430	1.15
1431	1.13
1548	1.14
1639	1.10
1761	1.16
CURVE 20	
95.4	4.73
98.4	4.73
199.5	4.41
292.6	4.13
CURVE 21	
71.2	88.0
83.2	5.57
CURVE 22*	
21.2	54.3
83.2	5.49
[illegible] 23	
2[illegible]	[illegible]7.[illegible]
83.2	5[illegible]
CURVE 24*	
21.2	25.3
83.2	5.28
CURVE 25	
14.5	59.5
14.8	59.1
16.2	60.2
17.1	58.1
18.0	56.5
19.0	56.5
20.1	54.9

T	k
CURVE 26*	
21.50	82.0
78.80	5.78
CURVE 27*	
369.2	3.77
449.1	3.73
539.0	3.71
746.0	3.59
897.9	3.52
CURVE 28	
2.5	6.1
2.8	7.2
3.7	10.4
4.7	12.7
5.2	14.8
7.8	21.9
10.0	25.1
11.4	27.4
12.2	29.0
13.3	29.8
15.7	33.5
16.2	35.6
18.7	33.4
22.9	33.1
25.5	29.4
27.0	26.5
30.7	25.1
31.5	23.2
36.8	20.3
40.7	17.6
CURVE 29*	
347.2	3.82
350.4	3.84
355.0	4.02
361.4	3.98
370.5	3.82
376.1	3.82
382.7	3.90
390.1	3.95
398.1	3.95

T	k
CURVE 29 (cont.)	
407.0	4.06
416.8	4.20
427.8	4.20
440.0	4.28
CURVE 30	
0.29	0.530
0.34	0.550
0.41	0.790
0.44	0.910
0.61	0.920
0.66	0.870
0.67	1.090
0.78	1.170
0.81	1.300
1.37	2.54
2.20	4.11
2.61	4.[illegible]3
2.96	5.39
3.15	5.91
3.60	6.22
4.22	7.13
CURVE 31	
107.2	4.62
113.2	4.51
123.2	4.41
148.2	4.16
173.2	4.07
198.2	4.01
223.2	3.95
248.2	3.90
273.2	3.86
291.2	3.83
299.2	3.80
CURVE 32	
366.5	3.77
477.6	3.67
588.7	3.58
700.0	3.49

T	k
CURVE 32 (cont.)	
811.0	3.41
922.0	3.34
1033.0	3.30
1144.0	3.25
CURVE 33	
2.62	11.0
3.54	14.4
4.15	18.0
4.70	20.5
5.38	22.9
6.00	25.3
6.62	27.5
9.70	38.8
10.7	42.6
11.5	44.1
12.0	45.9
16.3	49.5
19.4	48.6
24.0	44.6
27.8	37.2
30.7	31.4
33.2	25.3
38.0	20.4
44.5	14.9
56.6	9.00
61.1	8.21
67.7	7.03
78.5	5.72
90.5	5.31
CURVE 34	
1.81	1.02
2.00	1.17
2.22	1.32
2.54	1.53
2.98	1.78
3.53	2.11
3.72	2.11
4.07	2.44

*Not shown on plot

DATA TABLE NO. 12 (continued)

T	k
CURVE 35	
2.03	1.730
3.65	3.250
4.25	3.905
9.75	8.393
12.18	10.170
15.42	12.513
20.30	14.750
23.15	15.260
29.83	15.160
36.10	13.480
42.20	11.290
56.80	7.630
64.55	6.510
75.30	5.495
91.30	4.985
101.10	4.780
112.00	4.578
136.00	4.475
160.30	4.273
CURVE 36	
2.45	11.09
3.05	13.13
3.45	15.57
4.05	18.31
4.25	20.25
4.67	22.28
8.12	36.93
10.13	45.88
14.40	52.19
17.65	52.60
21.90	47.09
27.10	37.13
27.20	35.60
33.30	26.45
40.80	18.31
55.00	10.17
57.00	9.410
65.95	7.425
79.15	6.100
91.10	5.400
106.55	5.000
115.70	4.800
CURVE 36(cont.)	
130.10	4.700
155.40	4.600
CURVE 37*	
219.3	3.854
224.5	3.862
229.2	3.940
233.4	3.958
237.2	4.063
240.6	4.167
243.6	4.180
246.3	4.268
248.7	4.290
250.3	4.330
254.2	4.350
257.0	4.393
259.6	4.430
CURVE 38*	
305.2	3.845
CURVE 39*	
423.2	3.766
CURVE 40	
428.2	3.222
CURVE 41*	
423.2	3.682
CURVE 42*	
430.2	3.180
CURVE 43*	
308.2	3.800
333.2	3.789
CURVE 44*	
273.2	3.874
353.2	3.887
373.2	3.891
403.2	3.895
CURVE 45*	
273.2	3.757
353.2	3.778
373.2	3.782
403.2	3.791
CURVE 46*	
273.2	3.866
353.2	3.866
373.2	3.866
403.2	3.866
CURVE 47*	
273.2	3.761
353.2	3.782
373.2	3.786
403.2	3.795
CURVE 48	
338.7	3.548
422.1	3.548
533.2	3.531
CURVE 49	
338.7	3.029
422.1	3.081
533.2	3.115
CURVE 50	
338.7	2.856
422.1	2.942
533.2	3.029
CURVE 51	
1.88	0.093*
2.09	0.102*
2.32	0.114*
2.86	0.143*
3.54	0.183*
4.29	0.236
6.45	0.367
8.08	0.469
8.78	0.564
11.21	0.757
13.21	0.937
15.41	1.11
18.9	1.41
21.9	1.64
25.7	1.92
30.4	2.25
36.0	2.44
59.3	2.61
69.4	2.65
79.2	2.63
81.2	2.69
90.8	2.80
97.6	2.62
114.1	2.76
130.2	2.93
CURVE 52	
1.88	1.09
2.08	1.23
2.35	1.39
2.70	1.59
3.12	1.84
3.64	2.19
4.29	2.65
6.41	4.18
7.55	4.91
7.62	5.21
8.40	5.73
9.03	5.84
9.73	6.74
12.07	8.15
13.07	8.87
15.39	10.17
16.8	10.9
CURVE 52(cont.)	
18.8	11.7
20.9	12.2
25.2	13.2
29.6	12.9
34.5	12.3
37.4	11.9
59.8	7.05
67.6	6.20
78.4	5.45
91.1	4.95
112.5	4.48
128.9	4.44
141.8	4.51
CURVE 53*	
373.2	3.682
CURVE 54	
5.0	3.50
6.0	4.25
8.0	5.75
10.0	7.25
12.0	8.75
14.5	10.75
18.0	12.50
23.0	13.75
30.0	13.50
58.0	7.50
CURVE 55*	
303.2	3.94
CURVE 56	
2.53	1.49
2.58	1.56
2.79	1.64
3.01	1.79
3.19	1.81
3.31	1.93
3.45	2.00
3.78	2.17
CURVE 56(cont.)	
3.84	2.22
3.95	2.34
4.38	2.58
4.61	2.74
CURVE 57	
1673.2	1.20
1914.3	1.08
2087.6	1.15
2243.2	1.27
2353.7	1.17
2499.8	1.17
CURVE 58	
273.2	3.27
373.2	3.29
CURVE 59*	
285.7	3.838
CURVE 60	
273.2	3.55
CURVE 61*	
597.1	3.51
703.1	3.47
766.1	3.46
840.1	3.44
940.1	3.39
1004.1	3.36
1115.1	3.32
1225.1	3.11
1245.1	3.09
CURVE 62	
5.0	6.0
6.0	7.3
8.0	9.7
10.0	12.0
CURVE 62(cont.)	
20.0	19.6
23.0	20.5
30.0	19.1
40.0	13.8
CURVE 63	
4.0	3.2
5.0	4.0
6.0	4.7
8.0	6.35
10.0	8.0
20.0	13.3
28.0	14.4
30.0	14.1
40.0	11.8
CURVE 64	
5.0	0.091*
6.0	0.109*
8.0	0.150*
10.0	0.193*
20.0	0.435
30.0	0.665
40.0	0.850
60.0	1.10
80.0	1.27
100.0	1.39
CURVE 65*	
78.2	5.51
CURVE 66	
4	66.9
6	96.7
8	119.9
10	133.3
12	134.5
14	127.5
16	115.7
18	102.7
20	88.0
CURVE 66(cont.)	
22	75.0
24	63.5
26	53.5
28	45.25
30	38.50
32	33.10
34	28.60
36	24.90
38	21.75
40	19.20
65	7.04
75	5.7
85	5.1
95	4.7
105	4.4
CURVE 67	
4	6.37
6	9.45
8	12.5
10	15.57
12	18.4
14	20.85
16	22.8
18	23.9
20	24.41
22	24.44
24	24.00
26	23.09
28	21.87
30	20.45
32	19.08
34	17.69
36	16.32
38	15.03
40	13.88
45	11.4
65	6.4
75	5.36
85	4.85
95	4.55
105	4.3

*Not shown on plot

DATA TABLE NO. 12 (continued)

T	k
CURVE 68*	
291.2	3.90
CURVE 69*	
291.2	1.42
CURVE 70*	
273.2	3.91
CURVE 71*	
21.17	86.1
CURVE 72	
21.17	74.7
CURVE 73	
21.18	65.4
CURVE 74	
21.21	53.8
CURVE 75*	
21.23	49.4
CURVE 76	
21.25	47.0
CURVE 77	
21.17	86.1
CURVE 78	
21.18	75.7
CURVE 79	
21.19	64.0
CURVE 80*	
21.24	49.1
CURVE 81	
21.24	42.3
CURVE 82	
21.30	39.0
CURVE 83*	
291.2	3.92
CURVE 84*	
354.2	3.01
CURVE 85*	
21.0	16.1
91.0	5.23
273.0	4.18
290.5	4.18
373.0	4.18
CURVE 86	
293	2.13
473	2.48
CURVE 87*	
323.2	3.83
848.2	3.76
CURVE 88	
1.5	1.15
2.0	1.25
2.4	1.50
2.5	1.75
3.0	2.10
4.0	2.55
7.0	5.15
8.0	5.70
9.0	6.70
11.0	8.05
12.0	8.80
15.0	10.0
16.0	10.8
18.0	11.6
21.0	12.1
26.0	12.9
29.0	12.8
34.0	12.1
37.0	11.8
60.0	7.00*
67.0	6.05*
78.0	5.40*
91.0	4.90*
112.0	4.40*
129.0	4.35*
142.0	4.35*
CURVE 89	
20.4	127.1
20.6	124.6
20.8	122.2
21.1	120.5
73.0	8.16
80.4	6.56
83.0	5.95
273.0	4.10
CURVE 90*	
22.0	13.1
85.0	4.72
CURVE 90* (cont.)	
90.2	4.64
196.0	4.01
273.0	3.93
CURVE 91*	
78.2	5.50
273.2	3.97
CURVE 92*	
337.2	3.09
337.2	3.10
337.2	3.11
385.2	3.18
386.2	3.17
429.2	3.25
430.2	3.23
476.2	3.33
477.2	3.31
CURVE 93*	
337.2	2.41
337.2	2.46
337.2	2.47
388.2	2.53
390.2	2.54
393.2	2.56
436.2	2.62
439.2	2.65
442.2	2.66
488.2	2.73
493.2	2.74
494.2	2.78
CURVE 94	
325.2	1.50
325.2	1.51
341.2	1.53
341.2	1.53
CURVE 94 (cont.)	
357.2	1.56
357.2	1.56
358.2	1.56
396.2	1.64
397.2	1.64
443.2	1.72
444.2	1.72
495.2	1.82
496.2	1.82
CURVE 95*	
438.0	2.96
CURVE 96	
438.0	2.10
CURVE 97*	
438.0	2.90
CURVE 98*	
438.0	2.10
CURVE 99*	
332.2	3.84
CURVE 100*	
293.2	3.61
473.2	3.61
CURVE 101*	
293.2	3.28
473.2	3.42
CURVE 102	
763.7	3.59
1005	3.37
1146	3.31
1278	3.17
CURVE 103	
23.0	10.3*
23.8	10.4*
24.2	10.2*
26.0	10.9
27.3	11.3*
29.5	11.5*
31.3	11.3*
34.1	11.4*
34.7	11.2*
37.6	10.1
57.5	8.40
59.7	6.62*
71.7	5.58*
85.6	4.92*
99.8	4.53*
115.2	4.33*
130.1	4.22*
145.2	4.18*
159.6	4.14*
175.5	4.12*
211.7	4.08*
226.6	4.06*
245.2	4.05*
CURVE 104*	
80.2	5.52
273.2	4.00
CURVE 105*	
295.2	4.18
CURVE 106*	
363.2	3.78
CURVE 107*	
363.2	3.74
CURVE 108*	
363.2	3.78
CURVE 109*	
363.2	3.82
CURVE 110*	
14.5	59.5
14.8	59.2
16.2	60.2
17.1	58.1
18.0	56.5
19.0	56.5
20.1	54.9
CURVE 111	
293	3.52
473	3.66
CURVE 112	
320.1	4.03
362.6	4.03
407.7	4.02
443.0	4.02*
505.4	3.94
596.5	3.91
684.3	3.88*
722.6	3.87*
772.5	3.86

* Not shown on plot

DATA TABLE NO. 12 (continued)

CURVE 113

T	k
21.2	49.4
83.2	5.39

CURVE 114

T	k
21.2	46.3
83.2	5.30*

CURVE 115

T	k
21.2	19.0
83.2	5.14*

CURVE 116*

T	k
21.2	25.7
83.2	5.35

CURVE 117

T	k
21.2	20.4
83.2	5.25*

CURVE 118*

T	k
21.2	19.0
83.2	5.14

CURVE 119

T	k
21.2	27.4
83.2	5.32*

CURVE 120

T	k
2.0	58.8
2.5	71.3
3.0	90.8
4.0	107.5
4.5	120.0
6.0	159.3
9.5	190.0
13.0	173.5
17.0	138.2
22.0	92.0
27.5	55.8
55.0	9.8

CURVE 121*

T	k
21.2	24.1
83.2	5.21

CURVE 122

T	k
21.2	11.4
83.2	5.02

CURVE 123*

T	k
298.2	3.8

CURVE 124

T	k
0.50	0.740
0.52	0.770
0.58	0.870
0.612	0.900
0.64	0.960*
0.65	0.980
0.694	1.02
0.718	1.05
0.73	1.08
0.74	1.07
0.76	1.085
0.80	1.125
0.83	1.16
0.88	1.25

CURVE 125

T	k
0.42	0.198
0.456	0.205
0.51	0.245
0.595	0.290
0.65	0.300
0.70	0.340
0.74	0.350
0.793	0.365
0.84	0.380
0.88	0.395
0.93	0.405

CURVE 126

T	k
0.42	0.82
0.46	0.93
0.52	1.10
0.58	1.22
0.624	1.37
0.68	1.45
0.70	1.47*
0.72	1.49
0.77	1.55
0.83	1.62
0.85	1.68
0.89	1.78
0.94	1.90

CURVE 127*

T	k
273.2	3.011
373.2	3.023

CURVE 128

T	k
0.427	1.268
0.445	1.338
0.477	1.438
0.509	1.534
0.561	1.707
0.573	1.734
0.604	1.837
0.640	1.935
0.671	2.023
0.709	2.111
0.732	2.208
0.772	2.328
0.820	2.473
0.895	2.702
0.923	2.784
0.953	2.876
0.981	2.959
1.042	3.144
1.177	3.558
1.280	3.875
1.322	4.002
1.365	4.130
1.437	4.354
1.467	4.445

CURVE 129*

T	k
80.06	4.23
95.34	3.85
115.62	3.58
135.53	3.11
159.46	3.46
181.56	3.47
198.35	3.50
217.30	3.60

CURVE 130

T	k
198.53	3.53
220.90	3.60
240.88	3.66
257.38	3.63
275.40	3.65

CURVE 131*

T	k
298.2	0.00192

CURVE 132*

T	k
298.2	0.00328

CURVE 133*

T	k
298.2	0.00439

CURVE 134*

T	k
298.2	0.00628

CURVE 135*

T	k
298.2	0.0165

CURVE 136*

T	k
298.2	0.0201

CURVE 137*

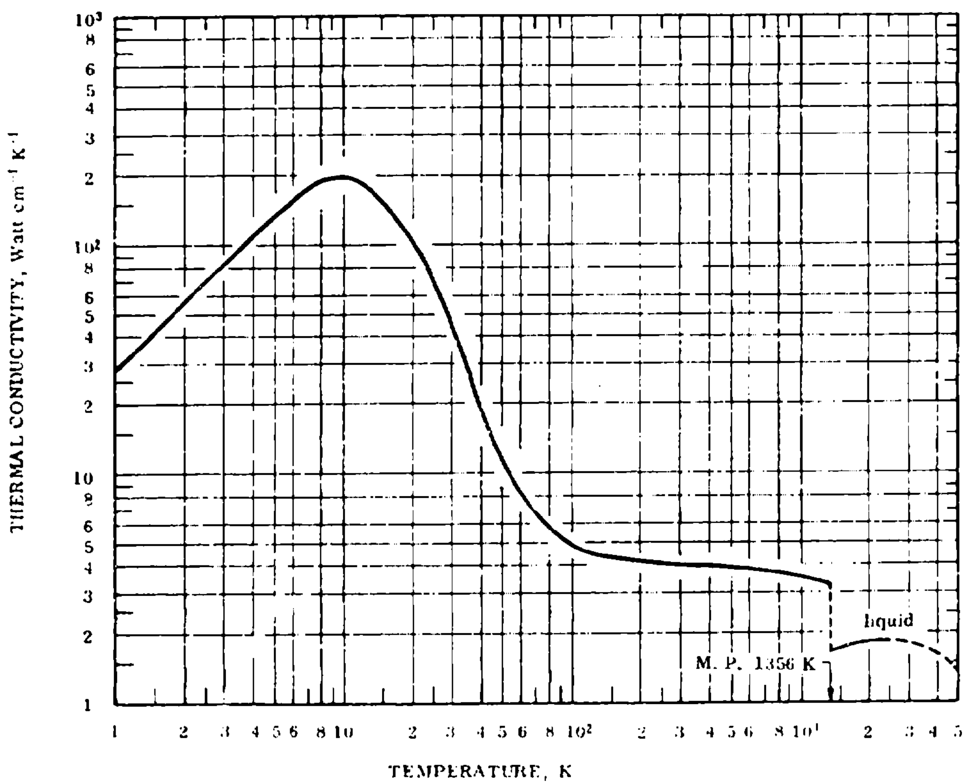
T	k
273.2	4.176

CURVE 138*

T	k
273.2	4.166

* Not shown on plot

FIGURE AND TABLE NO. 12R RECOMMENDED THERMAL CONDUCTIVITY OF COPPER



REMARKS

The recommended values are for well-annealed 99.999+% pure copper with residual electrical resistivity ρ_0 = 0.000851 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.40, a = 0.19, m = 2.59, $\alpha'' = 4.16 \times 10^{-6}$, and β = 0.0348. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature, and 3 to 5% at other temperatures.

RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	28.7	1660	-457.9
2	57.3	3310	-456.1
3	85.5	4940	-454.3
4	113	6530	-452.5
5	138	7970	-450.7
6	159	9190	-448.9
7	177	10200	-447.1
8	189	10900	-445.3
9	195	11300	-443.5
10	196	11300	-441.7
11	193	11200	-439.9
12	185	10700	-438.1
13	176	10200	-436.3
14	166	9590	-434.5
15	156	9010	-432.7
16	145	8380	-430.9
18	124	7160	-427.3
20	105	6070	-423.7
25	68	3930	-414.7
30	43	2480	-405.7
35	29	1680	-396.7
40	20.5	1180	-387.7
45	15.3	884	-378.7
50	12.2	705	-369.7
60	8.5	491	-351.7
70	6.7	387	-333.7
80	5.7	329	-315.7
90	5.14	297	-297.7
100	4.83	279	-279.7
150	4.28	247	-189.7
200	4.13	239	- 99.7
250	4.04	233	- 9.7
273.2	4.01	232	32.0
300	3.98	230	80.3
350	3.94	228	170.3
400	3.92	226	260.3
500	3.88	224	440.3
600	3.83	221	620.3
700	3.77	218	800.3
800	3.71	214	980.3
900	3.64	210	1160

T_1	k_1	k_2	T_2
1000	3.57	206	1340
1100	3.50	202	1520
1200	3.42	198	1700
1300	3.34	193	1880
1356	3.30	191	1981
In Liquid State			
1356	1.66	95.9	1981
1400	1.67	96.5	2060
1500	1.71	98.8	2240
1600	1.74	101	2420
1700	1.77	102	2600
1800	1.79	103	2780
1900	1.81	105	2960
2000	1.82	105	3140
2200	1.84	106	3500
2400	1.84	106	3860
2600	(1.84)‡	(106)	4200
2800	(1.83)	(106)	4580
3000	(1.80)	(104)	4940
3200	(1.78)	(103)	5300
3400	(1.74)	(101)	5660
3600	(1.70)	(98.2)	6020
3800	(1.66)	(95.9)	6380
4000	(1.61)	(93.0)	6740
4500	(1.48)	(85.5)	7640
5000	(1.33)	(76.8)	8540
5500	(1.17)	(67.6)	9440
6000	(0.989)	(57.1)	10340
7000	(0.611)	(35.3)	12140
8000	(0.212)	(12.2)	13940
8500	(0.036)	(2.08)	14840

*T_1 in K, k_1 in Watt cm^{-1}K^{-1}, T_2 in F, and k_2 in Btu hr^{-1}ft^{-1}F^{-1}.

‡Values in parentheses are estimated.

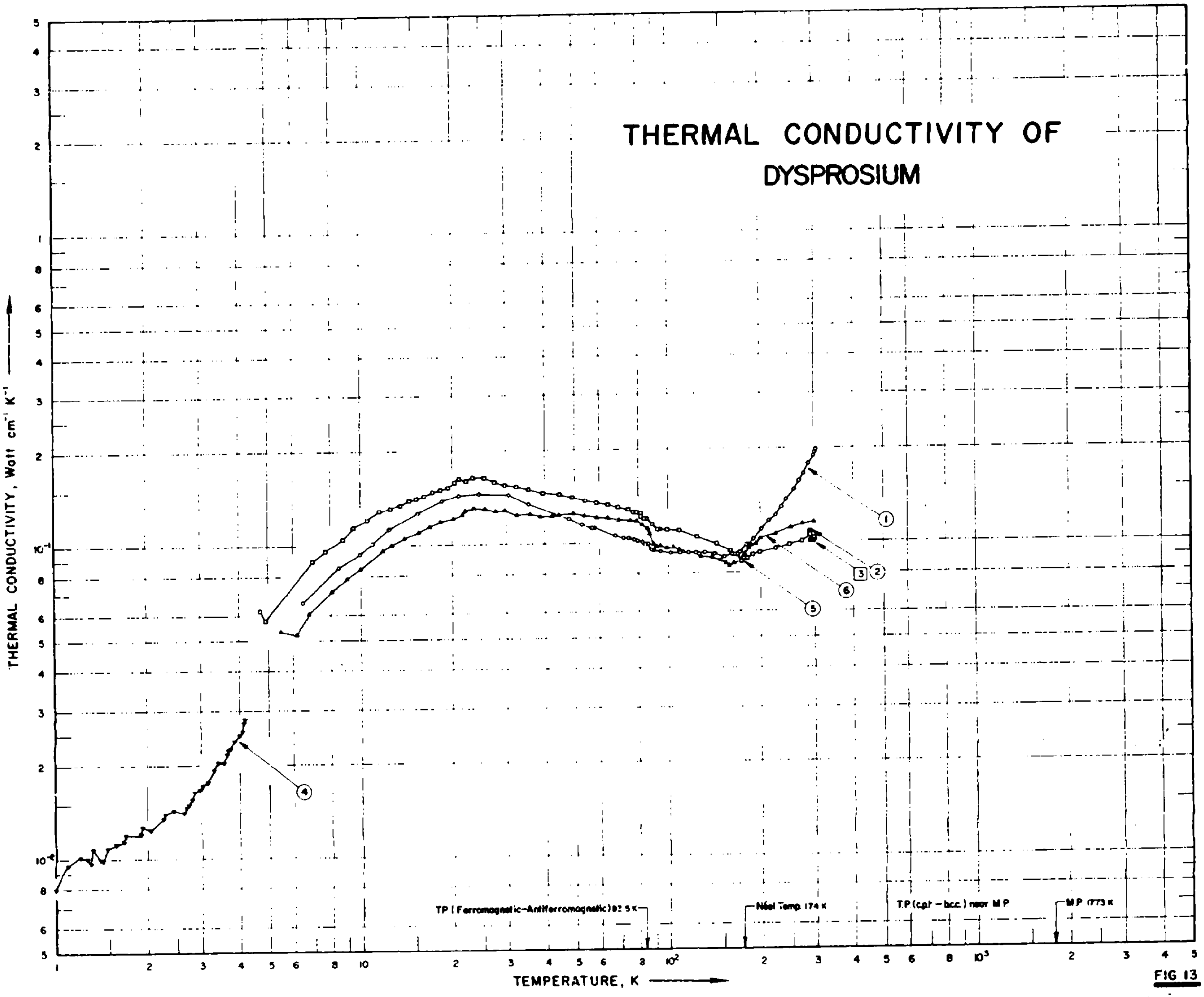

THERMAL CONDUCTIVITY OF
DYSPROSIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
TP (Ferromagnetic-Antiferromagnetic) 85.5 K
Néel Temp 174 K
T.P. (cph - bcc) near M.P.
M.P. 1773 K
1
2
3
4
5
6

FIG 13

SPECIFICATION TABLE NO. 13 THERMAL CONDUCTIVITY OF DYSPROSIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 13]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	807	L	1964	6.5-306	2		0.2 Ta, 0.1 Tb, 0.05 Ca, 0.05 Ho, 0.02 Er, 0.02 Si, 0.02 Y, 0.01 Fe, 0.01 Mg and traces of Cu and La; polycrystalline; 0.476 cm dia, 5 cm long; supplied by St. Eloi Corp.; electrical resistivity 9.55 μohm cm at 4.2 K; measured in a vacuum of ~6 x 10^{-6} mm Hg; T. P. (ferromagnetic - antiferromagnetic) 85 K; Néel temperature 180 K.
2	777	C	1965	291.2	3		High purity; polycrystalline; 0.25 in. long, 0.25 in. dia; supplied by Johnson Matthey and Co. Ltd.; electrical resistivity 105 μohm cm at 18 C; measurements made using two different thermal comparators; Monel metal used as comparative material.
3	811		1954	301.2	10		No information given.
4	261	L	1967	1.0-4.2	1		Pure polycrystalline specimen 1.5 mm in dia supplied by Johnson Matthey and Co.
5	‡	L	1968	4.7-300	6		0.0500 Er, 0.0500 Tb, 0.0400 Ta, < 0.0200 Gd, 0.0157 O, 0.0100 Fe, < 0.0100 Ho, < 0.0100 Si, < 0.0050 Al, < 0.0050 Cr, 0.0029 H, 0.0020 Ca, 0.0010 Mg, 0.0010 N, and < 0.0010 Y; single crystal; 9.48 x 2.30 x 2.12 mm; grown from arc-melted buttons using the strain anneal method; < 11$\bar{2}$0 > direction (a-axis) along the specimen axis; electrical resistivity reported as 4.60, 4.60, 4.62, 4.74, 5.47, 6.32, 8.20, 13.4, 20.7, 31.2, 35.1, 36.5, 38.1, 42.3, 52.7, 71.8, 83.2, 88.4, 93.4, 94.9, 99.4, and 111.5 μohm cm at 4.2, 6.9, 9.0, 12.0, 18.0, 22.1, 28.2, 40.1, 55.3, 75.0, 83.5, 86.0, 88.9, 94.4, 114.0, 143.8, 160.2, 167.6, 178.3, 188.6, 213.1, and 299.4 K, respectively; electrical resistivity ratio $\rho(300\ K)/\rho(4.2\ K)$ = 24.2; residual electrical resistivity 4.59 μohm cm; Lorenz function reported as 5.80, 4.99, 4.54, 4.76, 4.83, 5.14, 5.32, 5.16, 4.99, 4.97, 5.01, 4.96, 4.85, 4.64, 4.64, 4.26, 3.96, and 3.83 x $10^{-8} V^2 K^{-2}$ at 6.9, 11.6, 17.8, 25.7, 33.8, 45.5, 61.1, 78.8, 87.5, 94.2, 115.9, 146.2, 163.4, 175.6, 180.8, 227.8, 273.8, and 300.0 K, respectively; heat flow along the a-axis.
6	‡	L	1968	5.8-300	6		Single crystal; 12.79 x 2.21 x 2.19 mm; grown from arc-melted buttons using the strain anneal method; < 0001 > direction (c-axis) along the specimen axis; electrical resistivity reported as 5.79, 5.79, 5.88, 6.32, 7.01, 8.83, 11.7, 17.3, 26.7, 31.8, 33.8, 35.0, 36.1, 41.4, 42.0, 47.2, 63.1, 80.1, 83.1, 83.2, 83.0, 77.0, 70.6, 70.3, 70.3, 70.9, 73.7, and 77.2 μohm cm at 4.2, 8.0, 11.1, 16.0, 20.2, 26.0, 35.2, 49.6, 71.0, 81.1, 84.9, 87.0, 88.1, 88.9, 89.9, 98.1, 124.0, 150.1, 160.2, 163.2, 165.9, 174.3, 186.6, 194.6, 199.9, 219.1, 259.8, and 299.4 K, respectively; electrical resistivity ratio $\rho(300\ K)/\rho(4.2\ K)$ = 13.4; residual electrical resistivity 5.77 μohm cm; Lorenz function reported as 5.26, 4.53, 4.24, 4.28, 4.15, 4.46, 4.58, 4.56, 4.79, 4.64, 4.75, 4.72, 4.42, 3.91, 3.80, 3.59, 3.61, 3.37, 3.16, and 3.03 x $10^{-8} V^2 K^{-2}$ at 8.0, 13.7, 19.5, 23.9, 33.9, 58.7, 78.7, 86.1, 88.5, 91.4, 125.4, 141.5, 159.5, 174.9, 184.5, 192.9, 198.1, 228.3, 262.9, and 300.0 K, respectively; heat flow along the c-axis.

‡Boys, D.W. and Legvold, S., Phys. Rev., 174, 377-84, 1968; also USAEC IS-T-185, 1967.

DATA TABLE NO. 13 THERMAL CONDUCTIVITY OF DYSPROSIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
6.5	0.066
8.5	0.085
10.0	0.094
11.0	0.101
12.5	0.113
15.5	0.126
18.5	0.139
21.0	0.144
24.5	0.146
30.5	0.145
35.5	0.135
48.0	0.120
53.0	0.115
57.0	0.112
58.0	0.112
68.0	0.106
72.0	0.104
75.5	0.104
78.5	0.103
80.5	0.102
83.5	0.101
85.5	0.099
86.5	0.099*
87.5	0.099
89.5	0.095
90.3	0.095
90.5	0.095*
95.0	0.094
103.0	0.093
110.5	0.093
117.5	0.093
124.5	0.093
133.5	0.093
143.5	0.092
153.0	0.090
162.0	0.092
172.0	0.093
181.5	0.098
182.5	0.099*
191.0	0.103
203.0	0.110
214.5	0.117*

CURVE 1 (cont.)

T	k
215.5	0.117
225.0	0.123
235.0	0.130
244.5	0.137
257.0	0.148
267.5	0.157
278.0	0.166
289.0	0.177
299.5	0.189
302.5	0.193
306.0	0.197

CURVE 2

T	k
291.2	0.100
291.2	0.108

CURVE 3

T	k
301.2	0.100

CURVE 4

T	k
1.017	0.00799
1.146	0.00959
1.216	0.01031
1.277	0.01007
1.308	0.00979
1.317	0.01084
1.406	0.01005
1.432	0.00991
1.476	0.01092
1.576	0.01139
1.673	0.01158
1.705	0.01194
1.914	0.01210
1.937	0.01265
2.057	0.01236
2.270	0.01343
2.297	0.01388
2.437	0.01438
2.466	0.01448*

CURVE 4 (cont.)

T	k
2.638	0.01440
2.684	0.01462
2.742	0.01499
2.781	0.01569
2.869	0.01641
2.970	0.01673
3.045	0.01726
3.161	0.01762
3.165	0.01793*
3.165	0.01810*
3.299	0.01927
3.411	0.02042
3.463	0.02004*
3.577	0.02029
3.577	0.02077*
3.652	0.02162
3.692	0.02232
3.762	0.02238*
3.776	0.02256
3.861	0.02385
3.950	0.02397*
4.016	0.02484
4.097	0.02561
4.125	0.02641*
4.136	0.02737
4.218	0.02791

CURVE 5

T	k
4.7	0.062
4.9	0.059
7.1	0.089
7.9	0.096
9.0	0.105
10.1	0.114
11.0	0.120
12.0	0.128
13.0	0.132
13.9	0.135
15.1	0.139
16.0	0.142
16.8	0.144

CURVE 5 (cont.)

T	k
17.9	0.148
18.9	0.151
19.9	0.153
20.9	0.159
21.7	0.163
22.6	0.161
24.0	0.165
25.9	0.164
28.0	0.159
29.9	0.157
33.0	0.154
36.2	0.150
39.8	0.147
45.2	0.146
50.0	0.142
55.0	0.138
59.9	0.136
65.0	0.134
69.9	0.131
75.2	0.128
78.5	0.126
80.0	0.126
82.5	0.125
82.5	0.121
85.0	0.119
86.5	0.119
90.0	0.115
92.8	0.111
95.0	0.111
100.1	0.110
110.2	0.110
125.4	0.104
145.2	0.099
160.4	0.094
165.3	0.092
170.5	0.092
175.0	0.088
177.8	0.089
180.4	0.090
182.4	0.069
185.1	0.090
190.1	0.091

CURVE 5 (cont.)

T	k
200.0	0.093
225.0	0.095
249.9	0.099
275.1	0.101
299.5	0.103

CURVE 6

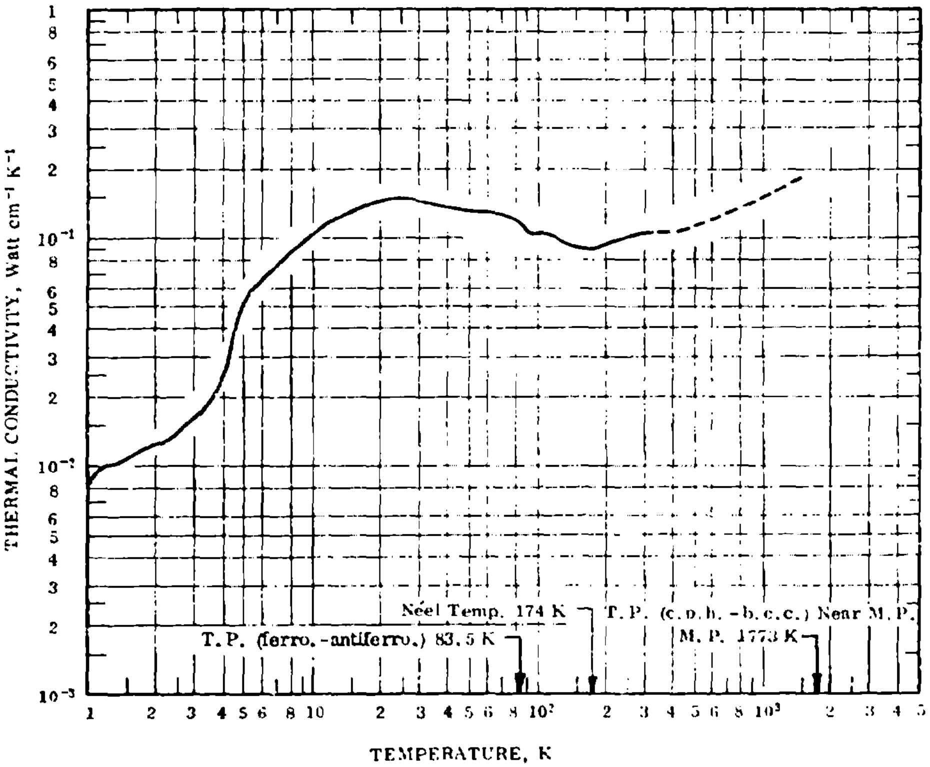
T	k
5.8	0.053
6.0	0.052
6.8	0.060
7.9	0.071
9.0	0.078
10.0	0.084
11.1	0.091
12.0	0.096
13.0	0.100
14.3	0.106
16.0	0.110
17.6	0.114
19.0	0.118
20.5	0.122
21.8	0.125
22.5	0.129
24.1	0.132
[illegible]	0.130
[illegible]	0.128
30.0	0.128
33.2	0.124
36.0	0.125
39.0	0.123
42.5	0.123
45.0	0.124
50.0	0.124
55.0	0.124
59.7	0.122
65.1	0.121
70.2	0.119
76.3	0.118
79.0	0.118
80.3	0.118
82.7	0.115

CURVE 6 (cont.)

T	k
85.2	0.114
85.4	0.115*
87.4	0.112
88.6	0.107
90.3	0.099
92.5	0.097
95.1	0.098
100.2	0.096
105.2	0.097
110.0	0.094
120.2	0.092
130.0	0.090
140.2	0.090
149.9	0.088
155.0	0.086
160.2	0.084
165.0	0.085
170.0	0.086
172.5	0.088
175.0	0.088*
177.5	0.091
180.1	0.096
182.5	0.096*
184.9	0.099
187.6	0.099
189.9	0.098
195.0	0.099
200.0	0.103
225.1	0.107
249.8	0.112
275.2	0.114
299.8	0.116

*Not shown on plot

FIGURE AND TABLE NO. 13R RECOMMENDED THERMAL CONDUCTIVITY OF DYSPROSIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	0.00834	0.492	-457.9
1.10	0.00934	0.540	-457.69
1.20	0.0101	0.584	-457.51
1.25	0.0102	0.589	-457.42
1.30	0.0102	0.589	-457.33
1.50	0.0109	0.630	-456.97
1.70	0.0117	0.676	-456.61
2	0.0125	0.722	-456.1
2.20	0.0129	0.745	-455.71
2.50	0.0140	0.809	-455.17
3	0.0166	0.959	-454.3
4	0.0249	1.44	-452.5
4.30	0.0302	1.74	-451.93
4.40	0.0335	1.94	-451.75
4.50	0.0387	2.24	-451.57
4.70	0.0448	2.59	-451.21
5	0.0518	2.99	-450.7
6	0.0667	3.85	-448.9
7	0.0781	4.51	-447.1
8	0.0882	5.10	-445.3
9	0.0970	5.60	-443.5
10	0.105	6.07	-441.7
11	0.112	6.47	-439.9
12	0.118	6.82	-438.1
13	0.123	7.11	-436.3
14	0.127	7.34	-434.5
15	0.131	7.57	-432.7
16	0.135	7.80	-430.9
18	0.141	8.15	-427.3
20	0.146	8.44	-423.7
25	0.151	8.72	-414.7
30	0.147	8.49	-405.7
35	0.142	8.20	-396.7
40	0.139	8.03	-387.7
45	0.137	7.92	-378.7
50	0.135	7.80	-369.7

T_1	k_1	k_2	T_2
60	0.130	7.51	-351.7
70	0.127	7.34	-333.7
80	0.122	7.05	-315.7
85	0.117	6.76	-306.7
90	0.109	6.30	-297.7
95	0.105	6.07	-288.7
100	0.105	6.07	-279.7
105	0.105	6.07	-270.7
110	0.105	6.07	-261.7
120	0.102	5.84	-243.7
150	0.0938	5.42	-189.7
170	0.0886	5.12	-153.7
200	0.0959	5.53	- 89.7
250	0.102	5.89	- 9.7
273.2	0.105	6.07	32.0
300	0.107	6.18	80.3
350	(0.108)‡	(6.24)	170.3
400	(0.109)	(6.30)	260.3
500	(0.114)	(6.59)	440.3
600	(0.122)	(7.05)	620.3
700	(0.129)	(7.45)	800.3
800	(0.137)	(7.92)	980.3
900	(0.144)	(8.32)	1160
1000	(0.152)	(8.78)	1340
1100	(0.159)	(9.19)	1520
1200	(0.167)	(9.65)	1700
1300	(0.174)	(10.1)	1880
1400	(0.181)	(10.5)	2060
1500	(0.188)	(10.9)	2240

REMARKS

The recommended values are for well-annealed 99.93% pure dysprosium with residual electrical resistivity ρ_0 = 4.7 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

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* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}. ‡Values in parentheses are estimated.

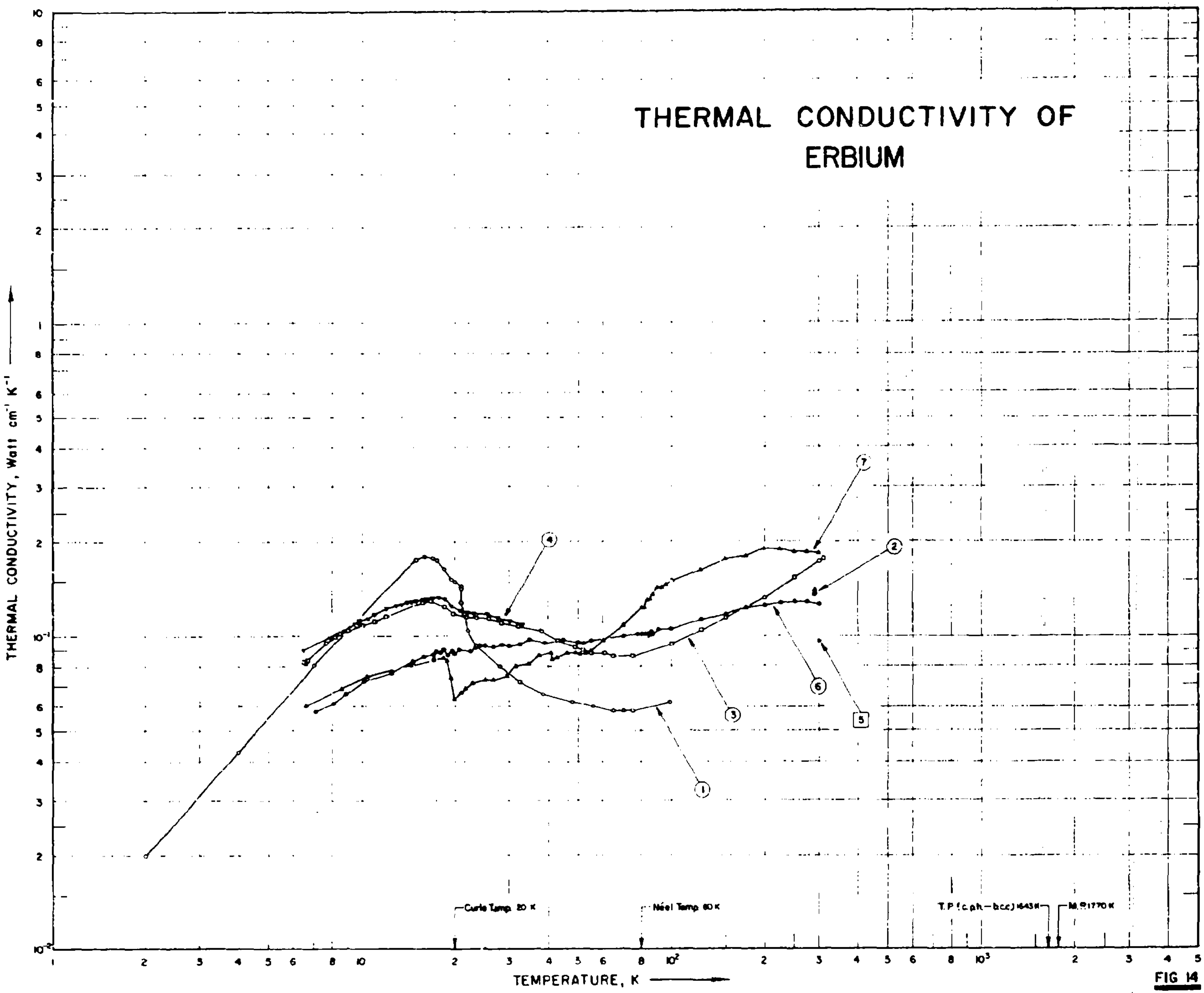

THERMAL CONDUCTIVITY OF ERBIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Curie Temp. 20 K
Néel Temp. 80 K
T.P. (c.p.h. — b.c.c.) 1643 K
M.P. 1770 K
1
2
3
4
5
6
7

FIG 14

SPECIFICATION TABLE NO. 14 THERMAL CONDUCTIVITY OF ERBIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 14]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	322, 808	L	1965	2-99			99.9 pure; polycrystalline; 3 x 0.2 x 0.025 cm; annealed at 650 C for 2 hr in vacuum of 10^{-6} mm Hg; electrical resistivity 8.44 μohm cm; electrical resistivity ratio ρ(298 K)/ρ(4.2 K) = 10.2; T.P. (ferromagnetic - antiferromagnetic) 20 K; Neel temperature 80 K; data taken from smoothed curve.
2	777	C	1965	291.2	3		High purity; polycrystalline; 0.25 in. dia. 0.25 in. thick; supplied by Johnson Matthey and Co. Ltd.; electrical resistivity 79 μohm cm at 18 C; measurements made using 2 different thermal comparators; Monel used as comparative material.
3	809	L	1965	6.5-310			0.01 Ca, 0.02 Ho, 0.005 Mg, 0.07 O, 0.01 Si, and trace Tm; polycrystalline; 0.476 cm dia, 6 cm long; supplied by Research Chemicals; arc-melted, machined, swaged, and annealed in vacuum (~10^{-5} torr) at 800 K for 50 hrs; T.P. (ferromagnetic - antiferromagnetic) 19 K; Néel temperature 86 K; data above 75 K extracted from smooth curve; electrical resistivity 3.79 μohm cm at 4.16 K; measured in vacuum.
4	809	L	1965	6.5-33			The second run of the above specimen; measured during cooling.
5	811		1954	301.2	10		No information given.
6	‡	L	1968	6.9-300	6		0.0500 Ta, 0.0235 O, 0.0260 Mg, < 0.0200 Ca, 0.0150 Cr, 0.0150 Fe, < 0.0100 Dy, < 0.0100 Ho, < 0.0050 Si, < 0.0050 Y, 0.0017 H, 0.0011 N, < 0.0010 Tm, < 0.0010 Yb, and traces of Cu and W; single crystal; 5.81 x 1.88 x 1.86 mm; grown from arc-melted buttons using the strain anneal method; < 10$\bar{1}$0 > direction (b-axis) along the specimen axis; electrical resistivity ratio ρ(300 K)/ρ(4.2 K) = 17.4; Lorenz function reported as 4.42, 3.91, 3.71, 3.99, 4.52, 4.90, 5.17, 5.24, 5.08, 4.73, 4.42, 3.94, and 3.75 x $10^{-8}V^2K^{-2}$ at 6.4, 10.3, 15.9, 22.0, 31.3, 43.8, 65.1, 80.0, 101.8, 126.4, 179.2, 260.1, and 299.9 K, respectively; heat flow along the b-axis.
7	‡	L	1968	4.9-300	6		0.0900 Fe, < 0.0500 Ta, 0.0280 O, 0.0200 Ca, 0.0200 Cr, 0.0200 Mg, 0.0130 Y, < 0.0100 Dy, < 0.0100 Ho, < 0.0050 Si, 0.0014 H, < 0.0010 Tm, < 0.0010 Yb, 0.0008 N, and traces of Cu, Ni, and W; single crystal; 6.13 x 1.51 x 1.31 mm; grown from arc-melted buttons using the strain anneal method; < 0001 > direction (c-axis) along the specimen axis; electrical resistivity ratio ρ(300 K)/ρ(4.2 K) = 10.1; Lorenz function reported as 4.45, 4.03, 3.88, 3.82, 3.88, 4.68, 5.30, 5.76, 6.48, 6.03, 5.31, 4.20, 3.83, 3.32, and 2.90 x $10^{-8}V^2K^{-2}$ at 4.2, 8.5, 11.6, 15.2, 18.4, 19.8, 32.1, 43.9, 53.0, 64.5, 73.3, 81.8, 131.6, 220.0, and 300.0 K, respectively; heat flow along the c-axis.

‡ Boys, D.W. and Legvold, S., Phys. Rev., 174, 377-84, 1968; also USAEC IS-T-185, 1967.

DATA TABLE NO. 14 THERMAL CONDUCTIVITY OF ERBIUM

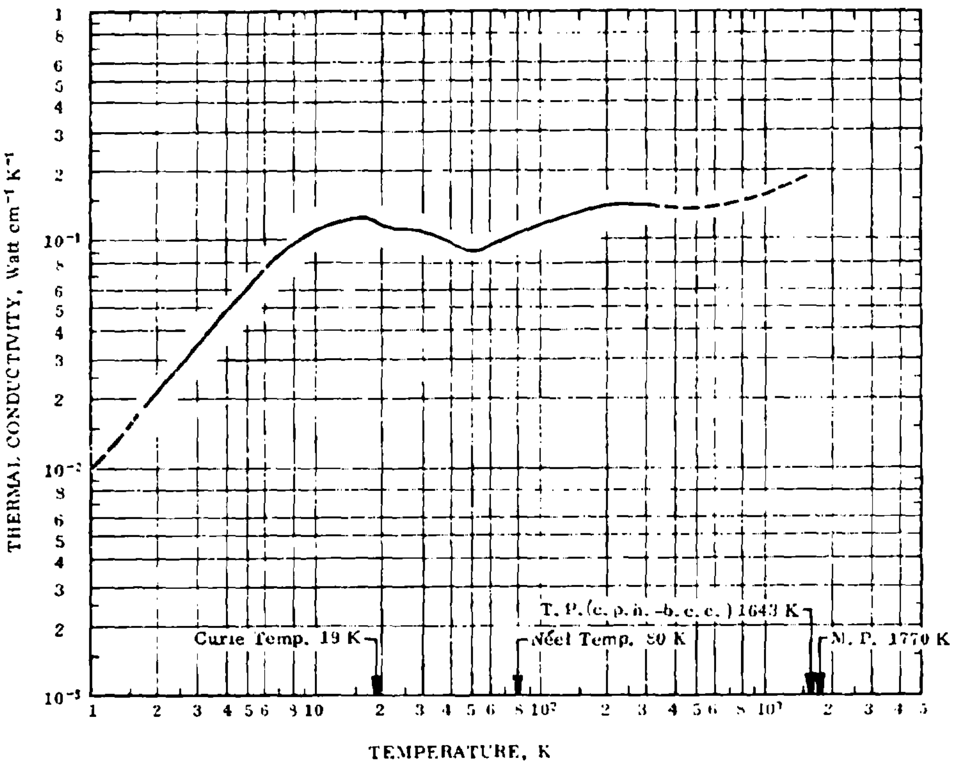
(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
2.0	0.020
4.0	0.043
7.0	0.081
15.0	0.176
16.0	0.179
17.0	0.177
17.5	0.175
18.5	0.164
19.5	0.152
20.0	0.149
21.0	0.144
21.0	0.142
21.0	0.128
21.5	0.118
22.0	0.105
23.5	0.093
28.0	0.080
32.5	0.072
38.5	0.066
48.0	0.062
56.0	0.060
65.0	0.058
70.0	0.058
75.0	0.058
99.0	0.062
CURVE 2	
291.2	0.136
291.2	0.140
CURVE 3	
6.60	0.0820
6.50	0.0825
6.60	0.0830*
6.70	0.0835
7.70	0.0950
8.20	0.0995
8.50	0.102
9.00	0.105
9.90	0.109
CURVE 3 (cont.)	
10.0	0.109
11.0	0.112
12.0	0.116
15.7	0.128
16.7	0.129
18.5	0.124
19.7	0.118
21.8	0.116
23.5	0.115
25.7	0.114
28.2	0.111
32.0	0.108
38.0	0.104
43.0	0.097
49.0	0.092
52.0	0.090
55.0	0.088
61.0	0.088
65.0	0.086
75.0	0.086
100	0.094
125	0.105
150	0.114
200	0.132
250	0.154
300	0.173
310	0.176
CURVE 4	
6.50	0.090
7.90	0.099
9.50	0.110
9.80	0.112
10.5	0.114
11.0	0.118
12.0	0.122
12.9	0.125
13.5	0.126
14.0	0.128
14.5	0.128
15.0	0.129
15.8	0.130
CURVE 4 (cont.)	
16.3	0.131
17.0	0.132
17.8	0.133
18.6	0.131
19.5	0.125
20.8	0.121
22.0	0.119
23.0	0.118
25.5	0.117
27.5	0.115
30.0	0.112
33.9	0.109
CURVE 5	
301.2	0.0962
CURVE 6	
6.9	0.059
7.2	0.058
7.6	0.059
8.1	0.062
9.2	0.066
10.4	0.072
12.1	0.077
13.5	0.080
15.0	0.082
16.6	0.086
17.5	0.087
18.4	0.089
18.9	0.090
19.6	0.087
20.0	0.088
21.5	0.090
22.5	0.090
23.6	0.092
24.5	0.094
25.5	0.093
27.5	0.093
29.2	0.094
30.2	0.094
33.1	0.094
CURVE 6 (cont.)	
35.5	0.097
40.4	0.095
45.5	0.097
50.5	0.095
52.5	0.095
55.7	0.098
60.6	0.098
70.6	0.101
78.7	0.102
80.4	0.102
82.5	0.102
83.5	0.102
84.5	0.102
85.3	0.101
86.5	0.104
87.4	0.101
90.9	0.106
100.3	0.106
125.6	0.113
150.4	0.117
175.7	0.123
200.8	0.125
226.0	0.128
250.9	0.128
275.8	0.128
300.2	0.126
CURVE 7	
4.9	0.046
6.9	0.060
7.9	0.066
8.9	0.069
10.1	0.072
10.9	0.075
12.1	0.077*
13.6	0.078
15.0	0.080
16.0	0.081
17.0	0.082
18.0	0.084
18.5	0.085
18.9	0.083
CURVE 7 (cont.)	
19.5	0.074
20.1	0.064
21.1	0.067
21.5	0.067
22.0	0.069
23.6	0.072
25.6	0.073
27.2	0.073
29.4	0.075
32.1	0.080
34.8	0.082
38.0	0.087
41.3	0.088
41.5	0.084
43.3	0.085
46.5	0.088
49.5	0.088
51.4	0.087
53.4	0.088
55.7	0.089*
60.7	0.097
70.4	0.108
80.7	0.123
81.9	0.123*
84.0	0.130
85.9	0.131
87.9	0.136
90.4	0.143
93.7	0.143
96.5	0.146
100.4	0.151
125.0	0.163
150.0	0.176
175.0	0.179
199.5	0.189
225.0	0.188
250.2	0.186
274.8	0.185
299.7	0.184

*Not shown on plot

FIGURE AND TABLE NO. 14R RECOMMENDED THERMAL CONDUCTIVITY OF ERBIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	40	0.101	5.84	-387.7
1	(0.0106)‡	(0.612)	-457.9	45	0.0948	5.48	-378.7
2	0.0227	1.31	-456.1	50	0.0928	5.36	-369.7
3	0.0356	2.06	-454.3	55	0.0935	5.40	-360.7
4	0.0488	2.82	-452.5	60	0.0967	5.59	-351.7
5	0.0625	3.61	-450.7	70	0.104	6.01	-333.7
6	0.0765	4.42	-448.9	80	0.110	6.36	-315.7
7	0.0890	5.14	-447.1	90	0.115	6.64	-297.7
8	0.0989	5.71	-445.3	100	0.119	6.88	-279.7
9	0.107	6.18	-443.5	150	0.134	7.74	-189.7
10	0.112	6.47	-441.7	200	0.143	8.26	- 99.7
11	0.117	6.76	-439.9	250	0.145	8.38	- 9.7
12	0.120	6.93	-438.1	273.2	0.144	8.32	32.0
13	0.123	7.11	-436.3	300	0.143	8.26	80.3
14	0.125	7.22	-434.5	350	(0.140)	(8.09)	170.3
15	0.128	7.40	-432.7	400	(0.139)	(8.03)	260.3
16	0.130	7.51	-430.9	500	(0.140)	(8.09)	4440.3
18	0.129	7.45	-427.3	600	(0.143)	(8.26)	620.3
20	0.120	6.93	-423.7	700	(0.146)	(8.44)	800.3
21	0.118	6.82	-421.9	800	(0.150)	(8.67)	980.3
22	0.118	6.82	-420.1	900	(0.154)	(8.90)	1160
24	0.117	6.76	-416.5	1000	(0.158)	(9.13)	1340
25	0.116	6.70	-414.7	1100	(0.163)	(9.42)	1520
30	0.111	6.41	-405.7	1200	(0.170)	(9.82)	1700
35	0.107	6.18	-396.7	1300	(0.177)	(10.2)	1880
				1400	(0.183)	(10.6)	2060
				1500	(0.190)	(11.0)	2240

REMARKS

The recommended values are for well-annealed 99.89^{+}% pure erbium with residual electrical resistivity ρ_0 = 3.79 μohm cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or estimated.

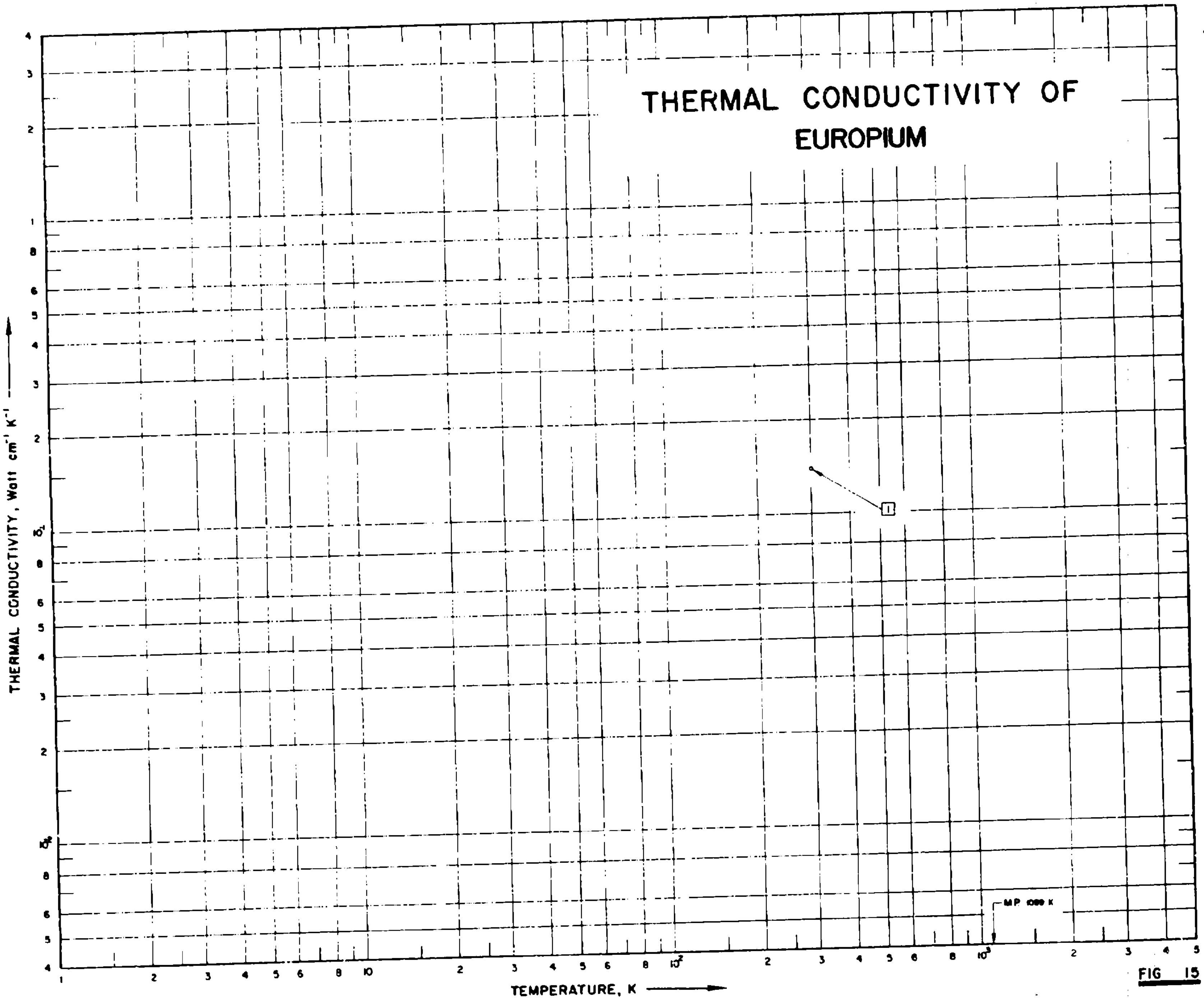

THERMAL CONDUCTIVITY OF
EUROPIUM
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
MP 1099 K
1

FIG 15

SPECIFICATION TABLE NO. 15 THERMAL CONDUCTIVITY OF EUROPIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 15]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	256	–	1966	300			Predicted value calculated from electrical resistivity value averaged from data of Spedding, F. H., et al. (Trans. AIME, 212, 379, 1958) and Colvin, R. V., et al. (Phys. Rev. 120, 741, 1960), and the Lorenz number $4.29 \times 10^{-8}\ V^2 K^{-2}$ based on the smoothed curve of Lorenz number vs. atomic number given by the authors.

DATA TABLE NO. 15 THERMAL CONDUCTIVITY OF EUROPIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
300	0.14

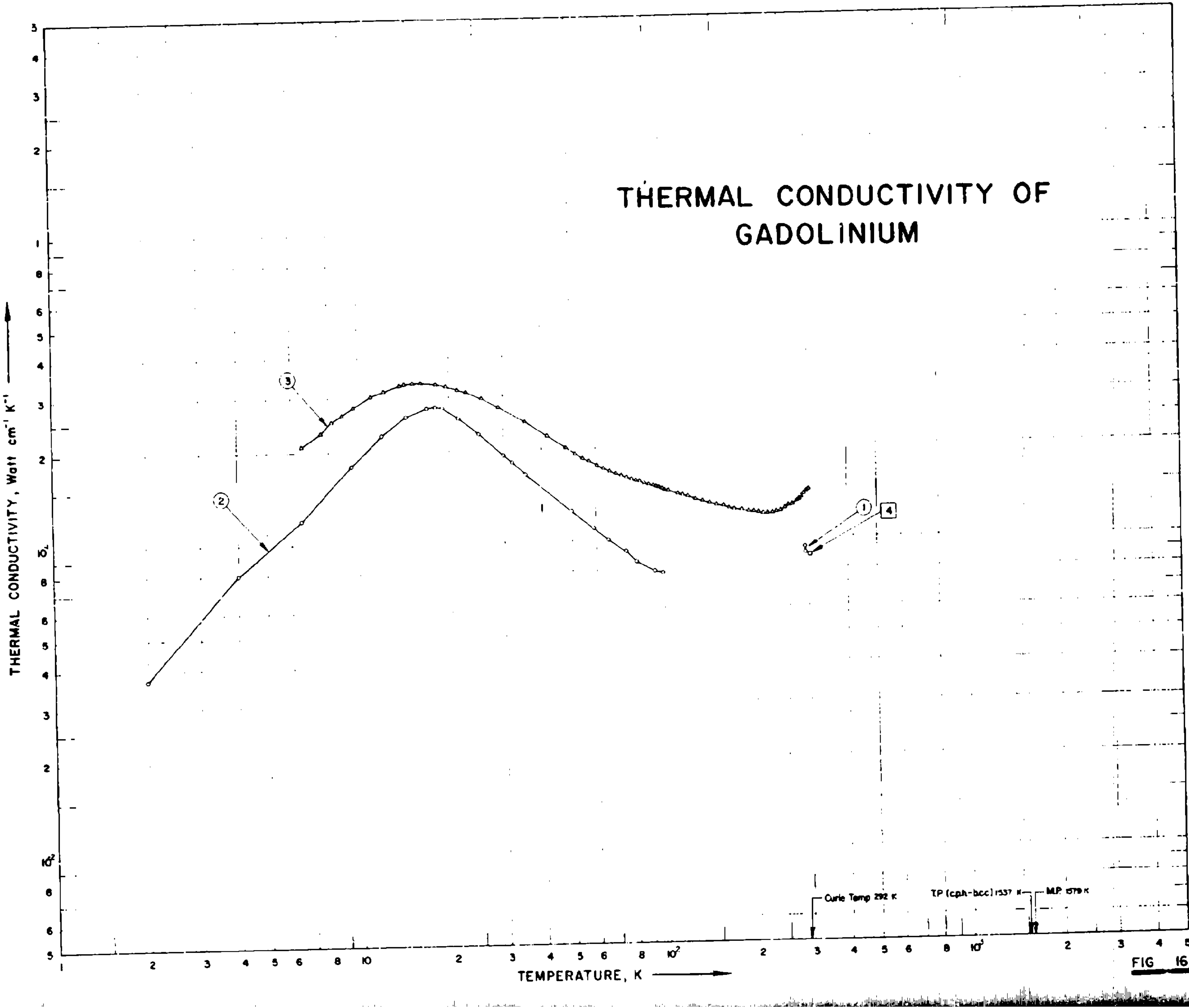

THERMAL CONDUCTIVITY OF GADOLINIUM
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
Curie Temp 292 K
T.P. (cph-bcc) 1537 K
M.P. 1579 K
1
2
3
4

FIG 16

SPECIFICATION TABLE NO. 16 THERMAL CONDUCTIVITY OF GADOLINIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 16]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	777	C	1965	291.2	± 3.0		High purity; polycrystalline; specimen 0.25 in. in diameter and 0.25 in. long; supplied by Johnson Matthey Co.; electrical resistivity reported at about 18 C as 134 μ ohm cm; Monel metal used as comparative material; measurements made using 2 different thermal comparators.
2	814	L	1966	2.0-99			99.9 pure; strip specimen 0.25 mm thick; baked for 1 1/2 hours at 650 C; measured in helium atmosphere; electrical resistivity reported at 4.2 K as 3.00 μ ohm cm; electrical resistivity ratio ρ(293 K) / ρ(4.2 K) = 47.4.
3	815	L	1964	6.5-300			Polycrystalline gadolinium; measured in vacuum at about 6 x 10^{-6} mm Hg; electrical resistivity reported at 4.18 K as 2.41 μ ohm cm; antiferromagnetic-paramagnetic transition occurred at ~ 270 K.
4	811		1954	301.2	10		No information given.

DATA TABLE NO. 16 THERMAL CONDUCTIVITY OF GADOLINIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
291.2	0.089
291.2	0.093

CURVE 2

T	k
2.0	0.037
4.0	0.080
6.5	0.120
9.5	0.190
12.0	0.225
14.5	0.258
17.0	0.273
18.0	0.276
19.0	0.275
21.5	0.253
25.0	0.225
30.0	0.192
32.0	0.182
35.5	0.166
50.0	0.126
59.0	0.110
66.0	0.100
75.0	0.092
81.0	0.085
93.0	0.079
99.0	0.078

CURVE 3

T	k
6.53	0.209
7.55	0.229
8.17	0.249
8.86	0.262
9.68	0.277
11.1	0.302
12.3	0.315
13.7	0.327
14.3	0.330
15.3	0.331
16.2	0.333
18.1	0.329
19.6	0.324

CURVE 3 (cont.)

T	k
21.3	0.315
22.7	0.309
25.6	0.295
29.0	0.274
35.4	0.244
41.8	0.220
48.2	0.201
51.7	0.193
54.5	0.186
57.1	0.182
57.6	0.180*
58.6	0.180*
60.8	0.176
63.9	0.172
67.2	0.168
70.3	0.165
73.2	0.163
76.1	0.160
79.1	0.157
81.8	0.156
83.9	0.155
86.6	0.153
89.6	0.151
92.7	0.149
94.5	0.148*
95.3	0.148
97.8	0.147
99.4	0.146
101.7	0.145
104.3	0.144
112.7	0.140
116.2	0.139
121.9	0.137
128.4	0.135
135.3	0.133
142.6	0.131
149.7	0.129
157.0	0.128
164.3	0.126
171.6	0.125
181.4	0.124

CURVE 3 (cont.)

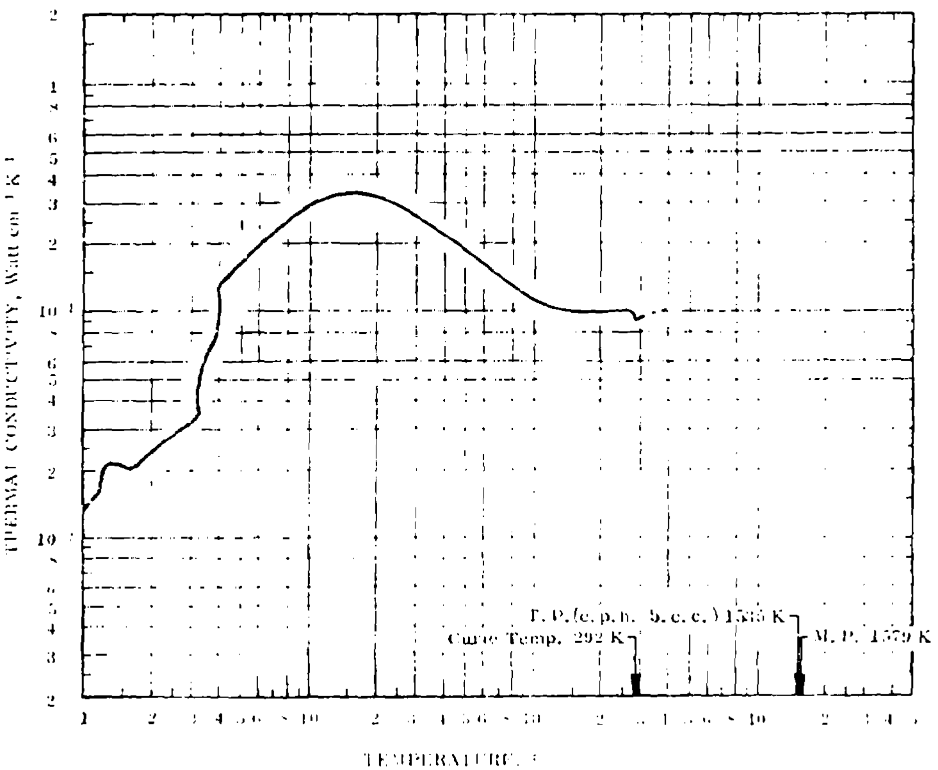
T	k
191.3	0.123
198.6	0.122
206.1	0.122
213.0	0.121
220.4	0.121
228.4	0.121
235.7	0.122
242.9	0.123
250.3	0.125
258.3	0.127
265.2	0.128
270.1	0.129*
275.4	0.131
279.8	0.133
284.9	0.136
289.7	0.138
294.6	0.141
299.5	0.143

CURVE 4

T	k
301.2	0.0878

* Not shown on plot

FIGURE AND TABLE NO. 16R RECOMMENDED THERMAL CONDUCTIVITY OF GADOLINIUM



RECOMMENDED VALUES[a]
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.67	15	0.335	19.4	-432.7
1	(0.0138)[‡]	(0.797)	-457.87	16	0.335	19.4	-430.9
1.15	0.0157	0.907	-457.60	18	0.332	19.2	-427.3
1.20	0.0167	0.965	-457.51	20	0.325	18.8	-423.7
1.22	0.0201	1.16	-457.47	25	0.297	17.2	-414.7
1.25	0.0212	1.22	-457.42	30	0.267	15.5	-405.7
1.30	0.0216	1.25	-457.33	35	0.245	14.2	-396.7
1.50	0.0211	1.22	-456.97	40	0.224	12.9	-387.7
1.60	0.0207	1.20	-456.79	45	0.206	11.9	-378.7
1.70	0.0213	1.23	-456.61	50	0.190	11.0	-369.7
2	0.0239	1.38	-456.07	60	0.164	9.48	-351.7
3	0.0319	1.84	-454.27	70	0.145	8.38	-333.7
3.10	0.0325	1.88	-454.09	80	0.132	7.63	-315.7
3.20	0.0335	1.94	-453.91	90	0.122	7.05	-297.7
3.22	0.0339	1.96	-453.87	100	0.115	6.64	-279.7
3.25	0.0416	2.40	-453.82	150	0.101	5.84	-189.7
3.30	0.0492	2.84	-453.73	200	0.0998	5.77	- 99.7
3.60	0.0641	3.70	-453.19	250	0.101	5.84	- 9.7
3.80	0.0724	4.18	-452.83	273.2	0.101	5.84	32.0
3.90	0.0795	4.59	-452.65	280	0.0998	5.77	44.3
4	0.103	5.95	-452.47	285	0.0923	5.33	53.3
4.02	0.120	6.93	-452.43	290	0.0916	5.29	62.3
4.10	0.131	7.57	-452.29	295	0.0921	5.32	71.3
4.20	0.135	7.80	-452.11	300	0.0928	5.36	80.3
4.50	0.145	8.38	-451.57	350	(0.0980)	(5.66)	170.3
5	0.161	9.30	-450.77	400	(0.101)	(5.84)	260.3
6	0.193	11.2	-448.9				
7	0.223	12.9	-447.1				
8	0.249	14.4	-445.3				
9	0.272	15.7	-441.7				
10	0.290	16.8	-441.7				
11	0.305	17.6	-439.9				
12	0.317	18.3	-438.1				
13	0.325	18.8	-436.3				
14	0.331	19.1	-434.5				

REMARKS:

The recommended values are for well-annealed high-purity gadolinium with residual electrical resistivity $\rho_0 = 2.41\ \mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

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[a] T_1 in K, k_1 in Watt $cm^{-1}\ K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1}\ ft^{-1}\ F^{-1}$. [‡] Values in parentheses are extrapolated.

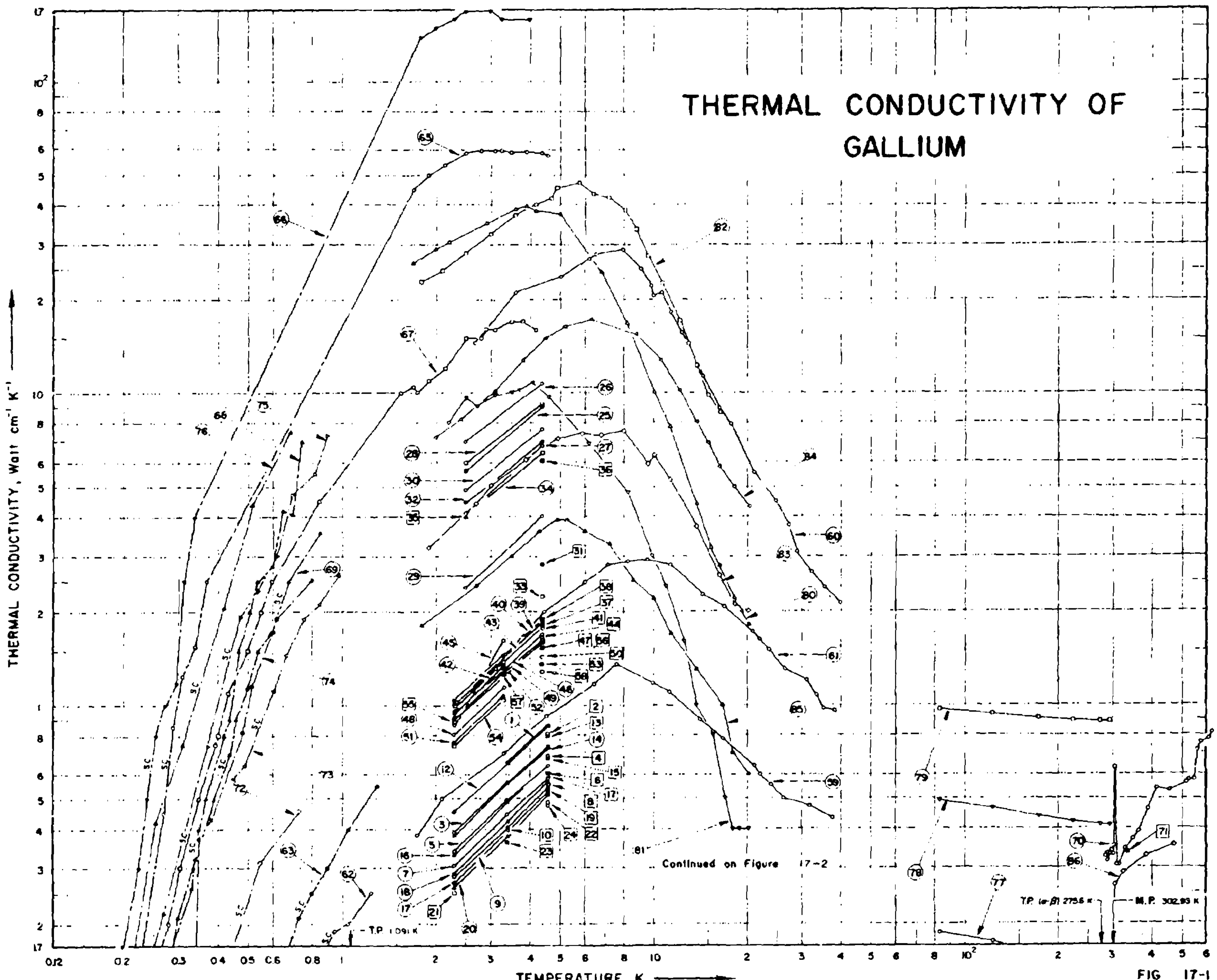

THERMAL CONDUCTIVITY OF
GALLIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Continued on Figure 17-2
T.P. 1.091 K
T.P. (α-β) 275.6 K
M.P. 302.93 K

FIG 17-1

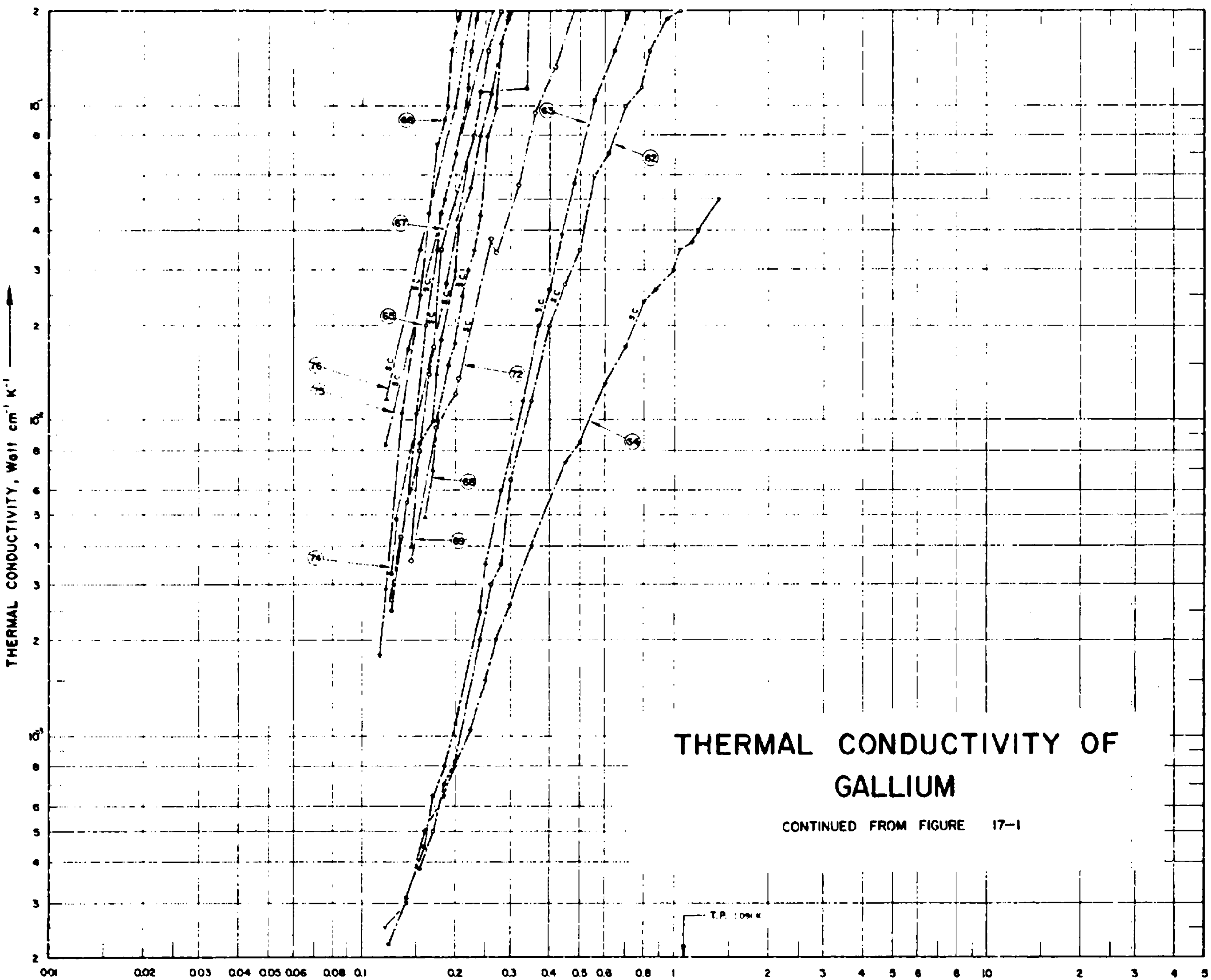

THERMAL CONDUCTIVITY OF GALLIUM
CONTINUED FROM FIGURE 17-1
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P.
62
63
64
65
66
67
68
69
72
74
75
76
S.C.

FIG 17-2

SPECIFICATION TABLE NO. 17 THERMAL CONDUCTIVITY OF GALLIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 17]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	342	L	1953	[illegible].4, 4.6		Ga 42-1	Single crystal; 2.92 cm long, 0.223 cm dia; supplied by National Physical Lab; rod axis parallel to the high electrical resistance direction of the crystal; measured in a longitudinal field of 0.36 KOe (kilooersted).
2	342	L	1953	[illegible].6		Ga 42-1	The above specimen measured in a longitudinal field of 0.73 KOe.
3	342	L	1953	2.3-4.6		Ga 42-1	The above specimen measured in a longitudinal field of 1.08 KOe.
4	342	L	1953	4.6		Ga 42-1	The above specimen measured in a longitudinal field of 1.47 KOe.
5	342	L	1953	2.3-4.6		Ga 42-1	The above specimen measured in a longitudinal field of 1.81 KOe.
6	342	L	1953	[illegible]		Ga 42-1	The above specimen measured in a longitudinal field of 2.15 KOe.
7	342	L	1953	2.3-4.6		Ga 42-1	The above specimen measured in a longitudinal field of 2.51 KOe.
8	342	L	1953	4.6		Ga 42-1	The above specimen measured in a longitudinal field of 2.98 KOe.
9	342	L	1953	2.3-4.6		Ga 42-1	The above specimen measured in a longitudinal field of 3.24 KOe.
10	342	L	1953	3.4		Ga 42-1	The above specimen measured in a longitudinal field of 3.62 KOe.
11	342	L	1953	2.3, 4.6		Ga 42-1	The above specimen measured in a longitudinal field of 3.65 KOe.
12	342	L	1953	2.3-4.6		Ga 42-1	The above specimen measured in a transverse field of 0.36 KOe.
13	342	L	1953	4.6		Ga 42-1	The above specimen measured in a transverse field of 0.73 KOe.
14	342	L	1953	2.3-4.6		Ga 42-1	The above specimen measured in a transverse field of 1.10 KOe.
15	342	L	1953	4.6		Ga 42-1	The above specimen measured in a transverse field of 1.42 KOe.
16	342	L	1953	2.3-4.6		Ga 42-1	The above specimen measured in a transverse field of 1.78 KOe.
17	342	L	1953	4.6		Ga 42-1	The above specimen measured in a transverse field of 2.17 KOe.
18	342	L	1953	2.3-4.6		Ga 42-1	The above specimen measured in a transverse field of 2.53 KOe.
19	342	L	1953	4.6		Ga 42-1	The above specimen measured in a transverse field of 2.90 KOe.
20	342	L	1953	2.3-4.6		Ga 42-1	The above specimen measured in a transverse field of 3.26 KOe.
21	342	L	1953	2.3		Ga 42-1	The above specimen measured in a transverse field of 3.54 KOe.
22	342	L	1953	4.6		Ga 42-1	The above specimen measured in a transverse field of 3.62 KOe.
23	342	L	1953	3.4		Ga 42-1	The above specimen measured in a transverse field of 3.66 KOe.
24	342	L	1953	4.6		Ga 42-1	The above specimen measured in a transverse field of 3.88 KOe.
25	342	L	1953	2.5, 4.4		Ga 42-2	Single crystal; 2.45 cm long, 0.218 cm dia; supplied by National Physical Lab; rod axis parallel to the low electrical resistance direction; measured in a transverse field of 0.35 KOe.

SPECIFICATION TABLE NO. 17 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
26	342	L	1953	2.5, 4.4		Ga 42-2	The above specimen measured in a longitudinal field of 0.35 KOe.
27	342	L	1953	2.5.4.4		Ga 42-2	The above specimen measured in a transverse field of 1.05 KOe.
28	342	L	1953	2.5.4.4		Ga 42-2	The above specimen measured in a longitudinal field of 1.05 KOe.
29	342	L	1953	2.5.4.4		Ga 42-2	The above specimen measured in a transverse field of 1.80 KOe.
30	342	L	1953	2.5.4.4		Ga 42-2	The above specimen measured in a longitudinal field of 1.80 KOe.
31	342	L	1953	4.4		Ga 42-2	The above specimen measured in a transverse field of 2.55 KOe.
32	342	L	1953	2.5, 4.4		Ga 42-2	The above specimen measured in a longitudinal field of 2.55 KOe.
33	342	L	1953	4.4		Ga 42-2	The above specimen measured in a transverse field of 3.24 KOe.
34	342	L	1953	2.5, 4.4		Ga 42-2	The above specimen measured in a longitudinal field of 3.24 KOe.
35	342	L	1953	2.5		Ga 42-2	The above specimen measured in a longitudinal field of 3.76 KOe.
36	342	L	1953	4.4		Ga 42-2	The above specimen measured in a longitudinal field of 3.91 KOe.
37	342	L	1953	4.4		Ga 42-2	The above specimen measured in a transverse field of 3.98 KOe.
38	342	L	1953	4.4		Ga 42-3	Single crystal; supplied by National Physical Lab; rod axis parallel to the intermediate electrical resistance direction; measured in a transverse field of 0.2 KOe.
39	342	L	1953	2.3, 4.4		Ga 42-3	The above specimen measured in a transverse field of 0.38 KOe.
40	342	L	1953	2.3-4.4		Ga 42-3	The above specimen measured in a longitudinal field of 0.38 KOe.
41	342	L	1953	4.4		Ga 42-3	The above specimen measured in a transverse field of 0.75 KOe.
42	342	L	1953	2.3, 3.3		Ga 42-3	The above specimen measured in a transverse field of 1.17 KOe.
43	342	L	1953	2.3-4.4		Ga 42-3	The above specimen measured in a longitudinal field of 1.17 KOe.
44	342	L	1953	4.4		Ga 42-3	The above specimen measured in a transverse field of 1.43 KOe.
45	342	L	1953	2.3, 3.3		Ga 42-3	The above specimen measured in a transverse field of 1.80 KOe.
46	342	L	1953	2.3, 4.4		Ga 42-3	The above specimen measured in a longitudinal field of 1.80 KOe.
47	342	L	1953	4.4		Ga 42-3	The above specimen measured in a transverse field of 2.16 KOe.
48	342	L	1953	2.3, 3.3		Ga 42-3	The above specimen measured in a transverse field of 2.53 KOe.
49	342	L	1953	2.3-4.4		Ga 42-3	The above specimen measured in a longitudinal field of 2.53 KOe.
50	342	L	1953	4.4		Ga 42-3	The above specimen measured in a transverse field of 2.90 KOe.
51	342	L	1953	2.3, 3.3		Ga 42-3	The above specimen measured in a transverse field of 3.22 KOe.
52	342	L	1953	2.3, 4.4		Ga 42-3	The above specimen measured in a longitudinal field of 3.22 KOe.

SPECIFICATION TABLE NO. 17 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
53	342	L	1953	4.4		Ga 42-3	The above specimen measured in a transverse field of 3.60 KOe.
54	342	L	1953	2.3, 3.3		Ga 42-3	The above specimen measured in a transverse field of 3.72 KOe.
55	342	L	1953	2.3		Ga 42-3	The above specimen measured in a longitudinal field of 3.7 [illegible]
56	342	L	1953	4.4		Ga 42-3	The above specimen measured in a longitudinal field of 3.84 KOe.
57	342	L	1953	3.3		Ga 42-3	The above specimen measured in a longitudinal field of 3.86 KOe.
58	342	L	1953	4.4		Ga 42-3	The above specimen measured in a transverse field of 4.09 KOe.
59	122	L	1955	1.8-38		Ga 42-1	Single crystal; 2.92 cm long, 0.223 cm in dia; supplied by National Physical Lab; rod axis parallel to the high electrical resistance direction of the crystal; electrical resistivity ratio $\rho_{(293K)}/\rho_{(0K)}$ 92.11.
60	122	L	1955	2.7-40		Ga 42-2	Single crystal; 2.45 cm long, 0.218 cm in dia; supplied by National Physical Lab; rod axis parallel to the low electrical resistance direction of the crystal; electrical resistivity ratio $\rho_{(293K)}/\rho_{(20K)}$ 111.
61	122	L	1955	2.3-29		Ga 42-3	Single crystal; supplied by National Physical Lab; rod axis parallel to the intermediate electrical resistance direction of the crystal; electrical resistivity ratio $\rho_{(293K)}/\rho_{(20K)}$ 106.5.
62	608	L	1960	0.16-1.3	10	3 Da	0.1 impurities (mainly Si, P, K, Ca, Al, Ti, and V); single crystalline rod; 3 mm dia; rod axis parallel to the crystallographic a-direction (a = 4.5258 Å); electrical resistivity ratio $\rho_{(293K)}/\rho_{(0K)}$ = 1.28 x 10^2; in superconducting state.
63	608	L	1960	0.12-1.3	10	3 Db	0.1 impurities (mainly Si, P, K, Ca, Al, Ti, and V); single crystalline rod; rod axis parallel to the crystallographic b-direction (b = 4.5198 Å); electrical resistivity ratio $\rho_{(293K)}/\rho_{(0K)}$ 1.18 x 10^2; in superconducting state.
64	608	L	1960	0.12-1.4	10	3 Dc	0.1 impurities (mainly Si, P, K, Ca, Al, Ti, and V); single crystalline rod; rod axis parallel to the crystallographic c-direction (c = 7.6602 Å); electrical resistivity ratio $\rho_{(293K)}/\rho_{(0K)}$ 0.67 x 10^2; in superconducting state.
65	608	L	1960	0.13-4.6	10	2 Pa	0.001 impurities (mainly Si, P, Ca, Al, Ti, and V); single crystalline rod; rod axis parallel to the crystallographic a-direction (a = 4.5258 Å); electrical resistivity ratio $\rho_{(293K)}/\rho_{(0K)}$ 2.08 x 10^4; in normal and superconducting state.
66	608	L	1960	0.12-4.0	10	2 Pb	0.001 impurities (mainly Si, P, Ca, Al, Ti, and V); single crystalline rod; rod axis parallel to the crystallographic b-direction (b = 4.5198 Å); electrical resistivity ratio $\rho_{(293K)}/\rho_{(0K)}$ 2.33 x 10^4; in normal and superconducting state.
67	608	L	1960	0.13-4.2	10	2 Pc	0.001 impurities (mainly Si, P, Ca, Al, Ti, and V); single crystalline rod; rod axis parallel to the crystallographic c-direction (c = 7.6602 Å); electrical resistivity ratio $\rho_{(293K)}/\rho_{(0K)}$ 1.35 x 10^4; in normal and superconducting state.
68	608	L	1960	0.16-0.75	10	b-3P	0.001 impurities (mainly Si, P, Ca, Al, Ti, and V); single crystalline rod, rod axis parallel to the crystallographic b-direction (b = 4.5198 Å); specimen 1.7 mm in dia; electrical resistivity ratio $\rho_{(293K)}/\rho_{(0K)}$ = 2.44 x 10^5; in superconducting state.

SPECIFICATION TABLE NO. 17 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
69	608	L	1960	0.15-0.85	10	c-4P	0.001 impurities (mainly Si, P, Ca, Al, Ti and V); single crystalline rod; rod axis parallel to the crystallographic c-direction (C = 7.6602 Å); dia 0.7 mm; electrical resistivity ratio $\rho(293\ K)/\rho_0 = 10^4$, in superconducting state.
70	597	L	1961	283-621	5		99.999 pure; measured in solid state and liquid state; 3 mm dia, 64 mm long; melting point 30 C.
71	757	C	1957	333			99.95 pure liquid gallium; supplied by Aluminum Company of America; mercury of 0.0001 impurity used as comparative material.
72	682	L	1960	0.2-0.7		c-6	0.0077 impurity; single crystalline; specimen 0.12 cm dia, approx 50 cm long; heated above the critical temperature after each measuring cycle and brought back into the superconducting state in a magnetic field compensated to approx 0.2 oersted; electrical resistivity ratio $\rho(293\ K)/\rho_0 = 1.85 \times 10^3$.
73	682	L	1960	0.5-1.0		c-7	Similar to the above specimen except 0.0023 impurity; 0.083 cm dia; $\rho(293\ K)/\rho_0 = 6.25 \times 10^3$.
74	682	L	1960	0.1-0.8		c-8	Similar to the above specimen except 0.0017 impurity; 0.16 cm dia; $\rho(293\ K)/\rho_0 = 8.33 \times 10^3$.
75	682	L	1960	0.1-0.9		c-9	Similar to the above specimen except 0.00086 impurity; 0.115 cm dia; $\rho(293\ K)/\rho_0 = 1.67 \times 10^4$.
76	682	L	1960	0.1-0.7		c-10	Similar to the above specimen except 0.0005 impurity; 0.11 cm dia; $\rho(293\ K)/\rho_0 = 2.78 \times 10^4$.
77	758	L	1963	83-293		Ga 14·2	Single crystalline rod; approx 4 mm in dia; supplied by National Chemical Laboratory; electrical resistivity reported as 12.0, 20.3, 30.8, 40.6, 50.3, and 54.3 µohm cm at 83, 123, 173, 223, 273, and 293 K, respectively; electrical resistivity ratio $\rho(293\ K)/\rho(20.4\ K) = 136$; heat flow parallel to the c-axis.
78	758	L	1963	83-293		Ga 14·5	Similar to the above specimen except electrical resistivity reported as 3.52, 6.18, 9.42, 12.7, 16.05, and 17.40 µohm cm at 83, 123, 173, 223, 273, and 293 K, respectively; electrical resistivity ratio $\rho(293\ K)/\rho(20.4\ K) = 159$; heat flow parallel to the a-axis.
79	758	L	1963	83-293		Ga 14·4	Similar to the above specimen except electrical resistivity reported as 1.72, 2.92, 4.44, 5.96, 7.48, and 8.10 µohm cm at 83, 123, 173, 223, 273, 293 K, respectively; electrical resistivity ratio $\rho(293\ K)/\rho(20.4\ K) = 155$; heat flow parallel to the b-axis.
80	759	L	1954	1.7-20		a_1	Impurities: 0.01 Hg, 0.001 Ca, 0.001 Fe, 0.001 Si, 0.0001-0.001 Pb, 0.0001 Mg, and 0.00001 Cu; single crystal; Ga supplied by Aluminum Company of America; electrical resistivity $\rho(273\ K) = 16.1$ µohm cm; electrical resistivity ratio $\rho(273\ K)/\rho(14\ K) = 588$; heat flow parallel to a-axis.
81	759	L	1954	2.2-20		c_1	Impurities: 0.01 Hg, 0.001 Ca, 0.001 Fe, 0.0001-0.001 Cu, 0.0001 Mg, and trace of Pb; $\rho(273\ K) = 52.0$ µohm cm; $\rho(273\ K)/\rho(14\ K) = 455$; heat flow parallel to c-axis.

SPECIFICATION TABLE NO. 17 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
82	759	L	1954	1.8-16		b_3	Impurities: 0.01 Hg, 0.001 Ca, 0.001 Fe, 0.0001-0.001 Cu, 0.0001 Mg, and trace of Pb; single crystal; Ga supplied by Aluminum Company of America; ρ(273 K) = 7.6 μohm cm; ρ(273 K)/ρ(14 K) = 625; heat flow parallel to b-axis.
83	759	L	1954	1.9-20		a_2	Impurities: 0.05-0.5 Hg, 0.001 Ca, 0.001 Fe, 0.001 Si, 0.0003-0.003 Pb, 0.0001-0.001 Cu, and 0.0001 Mg; single crystal; Ga supplied by Aluminum Company of America; ρ(273 K) = 19.8 μohm cm; ρ(273 K)/ρ(14 K) = 455; heat flow parallel to b-axis.
84	759	L	1954	2.0-20		b_7	Impurities: 0.01-0.1 Hg, 0.001 Ca, 0.001 Fe, 0.0001-0.001 Cu, 0.0001-0.001 Pb, and 0.0001 Mg; ρ(273 K) = 7.5 μohm cm; ρ(273 K)/ρ(14 K) = 476; heat flow parallel to b-axis.
85	759	L	1954	1.8-20		c_7	Impurities: 0.02-0.2 Hg, 0.001 Ca, 0.001 Fe, 0.0001-0.001 Cu, 0.0001 Mg, and trace of Pb, ρ(273 K) = 52.8 μohm cm; ρ(273 K) ρ(14 K) = 370 heat flow parallel to c-axis.
86	838	C	1966	278-473			The molten metal placed in a hole 21 mm in dia drilled in an asbestos cement cylinder of 30 mm height; steel 1Kh18N9T used as comparative material.

DATA TABLE NO. 17 THERMAL CONDUCTIVITY OF GALLIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

Curve	T	k
CURVE 1	3.4	0.662
	4.6	0.862
CURVE 2	4.6	0.802
CURVE 3	2.3	0.391
	3.4	0.568
	4.6	0.741
CURVE 4	4.6	0.690
CURVE 5	2.3	0.340
	3.4	0.495
	4.6	0.645
CURVE 6	4.6	0.606
CURVE 7	2.3	0.305
	3.4	0.446
	4.6	0.581
CURVE 8	4.6	0.559
CURVE 9	2.3	0.282
	3.4	0.407
	4.6	0.541
CURVE 10	3.4	0.400
CURVE 11	2.3	0.270
	4.6	0.526
CURVE 12	2.3	0.455
	3.4	0.658
	4.6	0.855
CURVE 13	4.6	0.800
CURVE 14	2.3	0.382
	3.4	0.568
	4.5	0.735
CURVE 15	4.6	0.680
CURVE 16	2.3	0.331
	3.4	0.490
	4.6	0.641
CURVE 17	4.6	0.599
CURVE 18	2.3	0.289
	3.4	0.427
	4.6	0.562
CURVE 19	4.6	0.535
CURVE 20	2.3	0.261
	3.4	0.380
	4.6	0.508
CURVE 21	2.3	0.249
CURVE 22	4.6	0.485
CURVE 23	3.4	0.364
CURVE 24	4.6	0.476
CURVE 25	2.5	5.68
	4.4	9.01
CURVE 26	2.5	7.04
	4.4	10.8
CURVE 27	2.5	4.12
	4.4	6.80
CURVE 28	2.5	6.02
	4.4	9.17
CURVE 29	2.5	2.39
	4.4	4.03
CURVE 30	2.5	4.93
	4.4	7.69
CURVE 31	4.4	2.83
CURVE 32	2.5	4.48
	4.4	6.99
CURVE 33	4.4	2.23
CURVE 34	2.5	4.12
	4.4	6.45
CURVE 35	2.5	4.0
CURVE 36	4.4	6.10
CURVE 37	4.4	1.82
CURVE 38	4.4	1.89
CURVE 39	2.3	1.02
	4.4	1.85
CURVE 40	2.3	1.04
	3.3	1.45
	4.4	1.89
CURVE 41	4.4	1.80
CURVE 42	2.3	0.943
	3.3	1.35
CURVE 43	2.3	1.00
	3.3	1.38
	4.4	1.80
CURVE 44*	4.4	1.66
CURVE 45	2.3	0.869
	3.3	1.62
CURVE 46	2.3	0.961
	3.3	1.30
	4.4	1.69
CURVE 47	4.4	1.54
CURVE 48	2.3	0.806
	3.3	1.[illegible]5
CURVE 49	2.3	0.917
	3.3	1.28
	4.4	1.63
CURVE 50	4.4	1.44
CURVE 51	2.3	0.763
	3.3	1.08
CURVE 52	2.3	0.909
	4.4	1.580
CURVE 53	4.4	1.36
CURVE 54	2.3	0.746
	3.3	1.05
CURVE 55	2.3	0.885
CURVE 56	4.4	1.54
CURVE 57	3.3	1.26
CURVE 58	4.4	1.28
CURVE 59	1.75	0.383
	2.10	0.500
	3.32	0.703
	4.55	0.927
	6.47	1.18
	7.62	1.36
	10.0	1.18
	11.3	1.11
	14.2	0.993
	16.8	0.780
	21.2	0.643
	22.1	0.600
	24.0	0.557
	26.4	0.503
	32.0	0.477
	37.8	0.433
CURVE 60	2.66	14.5
	3.62	21.1
	5.03	23.7
	6.21	27.1
	6.55	28.1
	7.97	29.1
	9.14	25.0
	9.83	22.2
	10.0	20.6
	10.7	21.1
	11.4	18.4
	12.4	15.7
	14.5	11.4
	16.4	8.99
	17.8	7.98
	21.1	5.59
	24.8	4.52
	27.4	3.78
	29.0	3.14
	32.4	2.66
	35.7	2.39
	40.0	2.13
CURVE 61	2.34	1.03
	3.11	1.32
	3.36	1.46
	4.43	2.0
	6.08	2.48
	7.17	2.92
	8.29	2.90
	9.69	2.94
	11.4	2.83
	14.4	2.28
	17.0	2.08
	20.9	1.73
	22.0	1.64
	23.6	1.52
	26.5	1.31
	31.1	1.21
	33.6	1.08
	35.4	0.983
	38.5	0.967
CURVE 62	0.155	0.000380
	0.170	0.000500
	0.185	0.000700
	0.200	0.000830
	0.240	0.00200
	0.260	0.00300
	0.280	0.00380
	0.300	0.00650
	0.350	0.0115
	0.400	0.0200
	0.450	0.0270
	0.500	0.0350
	0.560	0.0600
	0.620	0.0700
	0.700	0.100
	0.790	0.115
	0.840	0.150
	0.950	0.190
	1.05	0.200
	1.25	0.250

* Not shown on plot.

DATA TABLE NO. 17 (continued)

CURVE 63

T	k
0.123	0.000220
0.140	0.000[illegible]
0.160	0.000450
0.170	0.000650
0.185	0.000890
0.200	0.00110
0.240	0.00250
0.250	0.00350
0.280	0.00600
0.330	0.0115
0.370	0.0200
0.400	0.0260
0.440	0.0390
0.480	0.0570
0.520	0.0840
0.560	0.105
0.650	0.150
0.730	0.210
0.800	0.250
0.900	0.300
1.05	0.400
1.30	0.550

CURVE 64

T	k
0.120	0.000250
0.140	0.000300
0.160	0.000590
0.185	0.000650
0.209	0.000800
0.225	0.00105
0.250	0.00150
0.270	0.00200
0.300	0.00260
0.350	0.00400
0.400	0.00520
0.450	0.00740
0.500	0.00850
0.600	0.0130
0.700	0.0170
0.800	0.0240
0.880	0.0260
1.00	0.0300
1.05	0.0350
1.15	0.0370
1.20	0.0406
1.40	0.0500

CURVE 65

T	k
0.125	0.00250
0.140	0.00550
0.150	0.0105
0.160	0.0200
0.175	0.0350
0.180	0.0450
0.185	0.0500
0.200	0.0700
0.220	0.115
0.225	0.150
0.270	0.450
0.290	0.850
0.310	1.25
0.340	1.55
0.370	2.50
1.70	45.0
1.90	50.0
2.15	54.0
2.50	59.0
2.80	60.0
3.10	60.0
3.25	60.0
3.50	59.5
3.90	59.5
4.40	59.0
4.60	58.0

CURVE 66

T	k
0.115	0.00180
0.120	0.00390
0.135	0.0105
0.155	0.0250
0.165	0.0450
0.175	0.0750
0.185	0.0900
0.190	0.100
0.195	0.150
0.200	0.170
0.225	0.300
0.240	0.500
0.255	0.800
0.275	1.00
0.300	1.18
0.315	2.50
0.340	4.00
1.80	140.0

CURVE 66 (cont.)

T	k
2.00	150.0
2.30	160.0
2.50	170.0
3.00	170.0
3.25	160.0
4.00	160.0

CURVE 67

T	k
0.126	0.00270
0.134	0.00430
0.154	0.00800
0.165	0.0140
0.170	0.0170
0.180	0.0350
0.230	0.0800
0.255	0.150
0.280	0.200
0.305	0.300
0.350	0.500
0.395	0.750
0.405	0.800
0.435	1.10
0.500	1.50
0.550	2.00
0.600	2.50
0.850	4.50
1.55	10.0
1.70	10.5
1.75	10.0
1.90	11.0
2.15	12.0
2.50	15.0
2.80	15.0
2.90	16.0
3.10	16.0
3.50	17.0
3.80	17.0
4.20	16.0

CURVE 68

T	k
0.160	0.00490
0.169	0.00700
0.175	0.0100
0.190	0.0150
0.200	0.0175

CURVE 68 (cont.)

T	k
0.210	0.0250
0.220	0.0300
0.230	0.0350
0.240	0.0450
0.255	0.0800
0.270	0.100
0.280	0.160
0.330	0.260
0.350	0.400
0.370	0.500
0.420	0.800
0.440	0.900
0.470	1.50
0.510	2.00
0.540	2.50
0.600	2.80
0.650	4.20
0.700	4.10
0.750	7.00

CURVE 69

T	k
0.145	0.00400
0.155	0.00850
0.170	0.0100
0.175	0.0140
0.180	0.0180
0.200	0.0300
0.205	0.0410
0.225	0.0550
0.240	0.0800
0.260	0.110
0.300	0.2[illegible]0
0.340	0.320
0.390	0.500
0.440	0.700
0.460	0.900
0.500	1.15
0.540	1.50
0.590	1.70
0.680	2.50
0.850	3.60

CURVE 70

T	k
283.0	0.326
285.9	0.331
288.3	0.314
292.6	0.331
296.9	0.339
299.4	0.331
301.2	0.351
302.9	0.628
307.8	0.305
314.9	0.305
328.2	0.343
347.7	0.368
361.4	0.389
387.9	0.460
411.4	0.540
457.6	0.531
513.1	0.561
521.2	0.[illegible]
542.5	0.577
559.9	0.711
571.5	0.757
607.2	0.782
621.[illegible]	0.812

CURVE 71

T	k
333.2	0.336

CURVE 72

T	k
0.145	0.00355
0.174	0.00940
0.20	0.0120
0.205	0.0135
0.26	0.0380
0.27	0.0342
0.32	0.056
0.36	0.095
0.42	0.134
0.55	0.311
0.73	0.455

CURVE 73

T	k
0.45	0.58
0.49	0.64
0.61	1.12
0.67	1.45
0.76	1.90
0.85	2.11
0.91	2.60

CURVE 74

T	k
0.125	0.0032
0.130	0.0048
0.189	0.027
0.242	0.112
0.34	0.115
0.35	0.37
0.385	0.43
0.485	0.82
0.52	1.15
0.60	1.71
0.62	1.90
0.80	2.50

CURVE 75

T	k
0.12	0.0082
0.142	0.0166
0.22	0.102
0.27	0.215
0.375	0.74
0.475	1.93
0.54	2.32
0.62	3.01
0.70	4.7
0.82	5.5
0.90	7.3

CURVE 76

T	k
0.12	0.0115
0.155	0.0350
0.20	0.100
0.255	0.420
0.310	0.744
0.42	2.05
0.52	4.35
0.69	7.50

CURVE 77

T	k
83	0.186
123	0.174
173	0.162*
223	0.160*
273	0.160*
293	0.160*

CURVE 78

T	k
83	0.490
123	0.462
173	0.437
223	0.420
273	0.410
293	0.408

CURVE 79

T	k
83	0.967
123	0.932
173	0.904
223	0.890
273	0.886
293	0.884

CURVE 80

T	k
1.7	26.0
2.0	28.8
2.2	30.4
2.9	34.8
3.6	38.4
3.9	39.2
4.2	38.0
5.0	37.0
6.8	24.4
8.2	16.8
10.0	10.0
11.3	7.8
13.8	4.4
15.2	3.2
16.3	2.8
18.2	2.2
19.2	2.0
20.2	1.8

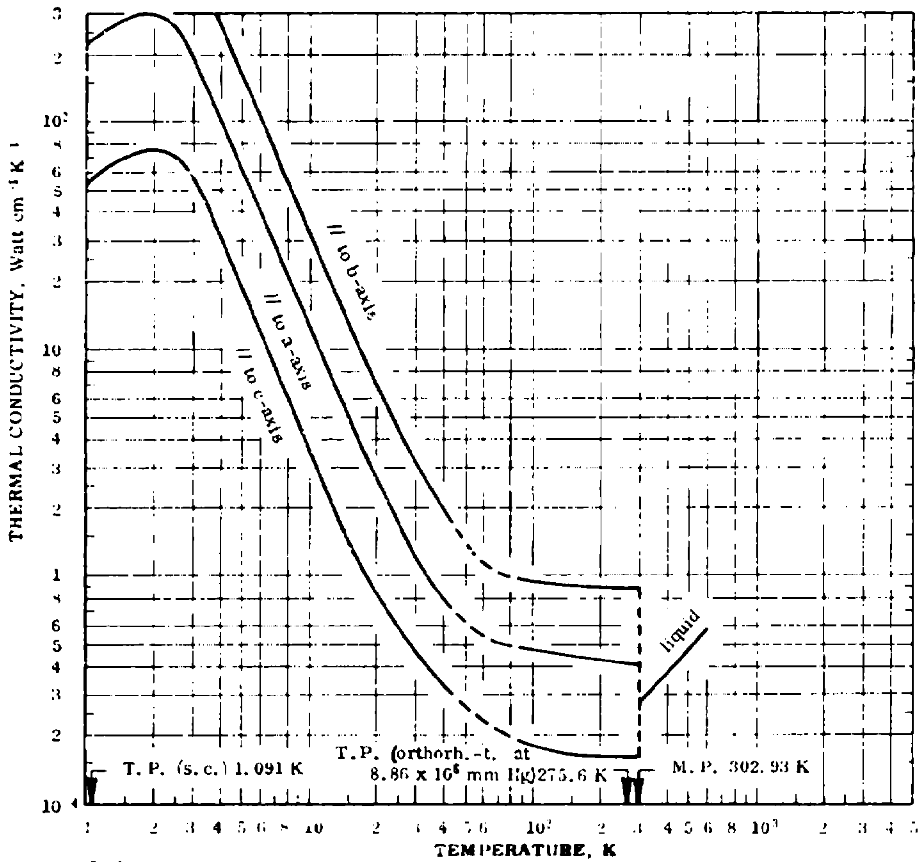
*Not shown on plot

DATA TABLE NO. 17 (continued)

T	k
CURVE 81	
2.2	8.0
2.5	9.6
2.7	9.0
3.1	9.8
3.5	10.0
3.7	10.2
4.1	10.8
4.6	9.6
6.2	6.8
8.3	4.8
9.9	3.0
11.0	2.4
12.6	1.6
13.8	1.0
15.6	0.8
17.0	0.5
18.0	0.4
18.9	0.4
20.0	0.4*
20.2	0.[illegible]
CURVE 82	
1.8	22.6
2.1	24.6
2.5	28.0
3.0	32.4
3.6	36.8
4.2	39.8
4.7	41.8
4.9	45.2
5.8	47.0
6.4	43.2
7.2	42.0
8.1	38.2
8.8	33.2
9.6	27.4
10.7	22.4
12.1	17.0
13.0	14.4
13.8	12.2
14.9	9.8
16.4	8.6
CURVE 83	
1.9	3.2
2.7	4.4
3.[illegible]	5.1
3.9	6.1
4.3	6.5*
4.9	7.1
5.9	7.4
6.8	7.3
8.0	7.5
9.6	5.9
10.0	6.3
11.3	5.3
13.8	3.7
16.3	2.6
18.3	2.1
20.1	2.0
CURVE 84	
2.0	7.2
2.4	8.2
2.7	9.1*
3.1	10.1
3.8	12.7
4.5	14.9
5.2	16.3
6.3	17.0
8.8	15.4
10.6	12.7
12.2	10.1
13.8	8.0
15.0	6.9
16.4	5.8
18.2	5.0
20.3	4.3
CURVE 85	
1.8	1.8
2.7	2.4
3.5	3.0
4.3	3.6
4.9	3.9
5.3	3.9
CURVE 85 (cont.)	
6.0	3.6
7.2	3.3
8.6	2.5
10.0	2.2
11.4	1.7
13.8	1.3
16.7	1.0
18.0	0.7
20.3	0.6
CURVE 86	
278.2	0.167*
288.2	0.163*
300.2	0.151*
305.2	0.264
325.2	0.289
382.2	0.327
473.2	0.352

*Not shown on plot

FIGURE AND TABLE NO. 17R RECOMMENDED THERMAL CONDUCTIVITY OF GALLIUM



RECOMMENDED VALUES*

T_1	k₁ (// to a-axis)	k₂ (// to a-axis)	k₁ (// to b-axis)	k₂ (// to b-axis)	k₁ (// to c-axis)	k₂ (// to c-axis)	T_2
0	0	0	0	0	0	0	-459.7
1	226	13100	657	38000	54.1	3130	-457.9
2	298	17200	832	48100	76.0	4390	-456.1
3	194	10100	524	30300	58.2	3360	-454.3
4	99.3	5740	272	15700	31.1	1800	-452.5
5	59.2	3420	163	9420	18.2	1050	-450.7
6	38.8	2240	107	6180	11.8	682	-448.9
7	27.2	1570	74.0	4280	8.15	471	-447.1
8	19.9	1150	54.2	3130	5.93	343	-445.3
9	15.2	878	41.4	2390	4.47	258	-443.5
10	11.9	688	32.5	1880	3.49	202	-441.7
12	7.98	461	21.6	1259	2.33	135	-438.1
15	4.88	282	13.2	763	1.44	83.2	-432.7
20	2.65	153	7.13	412	0.835	48.2	-423.7
25	1.71	98.8	4.54	262	0.588	34.0	-414.7
30	1.23	71.1	3.22	186	0.462	26.7	-405.7
35	0.952	55.0	2.46	142	0.385	22.2	-396.7
40	0.795	45.9	1.98	114	0.333	19.2	-387.7
50	(0.634)‡	(36.6)	(1.42)	(82.0)	(0.269)	(15.5)	-369.7
60	(0.555)	(32.1)	(1.15)	(66.4)	(0.233)	(13.5)	-351.7
70	(0.516)	(29.8)	(1.02)	(58.9)	(0.210)	(12.1)	-333.7
80	(0.494)	(28.5)	(0.983)	(56.8)	(0.196)	(11.3)	-315.7
90	0.483	27.9	0.960	55.5	0.187	10.8	-297.7
100	0.474	27.4	0.951	54.9	0.181	10.5	-279.7
150	0.443	25.6	0.918	53.0	0.167	9.65	-189.7
200	0.424	24.5	0.896	51.8	0.163	9.42	- 99.7
250	0.414	23.9	0.885	51.1	0.160	9.24	- 9.7
273.2	0.410	23.7	0.884	51.1	0.160	9.24	32.0
300	0.406	23.5	0.883	51.0	0.159	9.19	80.3
302.93	0.406	23.5	0.883	51.0	0.159	9.19	85.60

In Liquid State

T_1	k_1	k_2	T_2
302.93	0.281	16.2	85.60
400	0.378	21.8	260.3
500	0.482	27.8	440.3
600	0.586	33.9	620.3

REMARKS

The recommended values are for 99.9999% pure gallium with residual electrical resistivity ρ_0 = 0.000100, 0.0000341, and 0.000424 $\mu\Omega$ cm along directions parallel to a-, b-, and c-axis, respectively (characterization by ρ_0 becomes important at temperatures below about 150 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, α' = 3.28 x 10^{-4}, and β = 0.00409 for the direction parallel to a-axis; using n = 2.00, α' = 1.26 x 10^{-4}, and β = 0.00140 for the direction parallel to b-axis; and using n = 2.00, α' = 11.2 x 10^{-4}, and β = 0.0174 for the direction parallel to c-axis. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature and 4 to 15% at other temperatures.

*T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}. ‡Values in parentheses are interpolated.

**The values recommended for gallium single crystal in the direction parallel to the a-axis are also approximately good for polycrystalline gallium.

FIGURE SHOWS ONLY 80 OF THE CURVES REPORTED IN TABLE

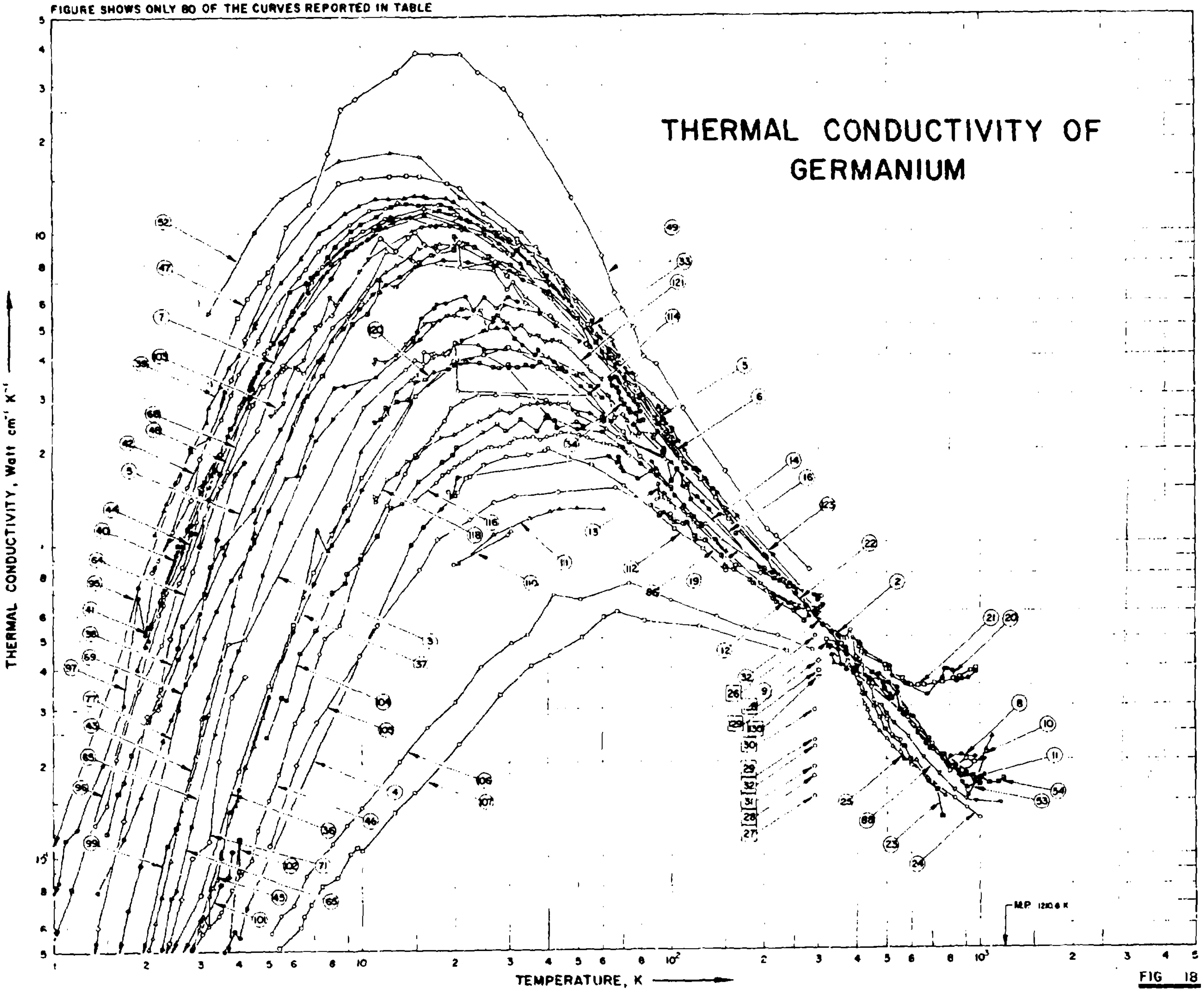


FIG 18

SPECIFICATION TABLE NO. 18 THERMAL CONDUCTIVITY OF GERMANIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 18]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	264	C	1952	298-373	10		High-purity; n-type single crystal; 0.313 x 0.313 x 0.75 in.; heat flow parallel to [100] crystalline axis; Ni and Zn used as comparative materials.
2	267	C	1955	278-365			High-purity; n-type single crystal; supplied by Westinghouse Research Laboratories; heat flow parallel to the [100] crystal direction; cast Zn and cast Ni used as comparative materials.
3	155	L	1951	2.7-79	20		High-purity; single crystal; 0.25 in. in dia and ~1.5 in. long; prepared by melting in a graphite crucible, solidified slowly by lowering the crucible through the furnace at a rate of 3 in. hr^{-1}; electrical resistivity 0.30 ohm cm at room temperature.
4	155	L	1951	2.7-86	< 20		0.0022 Al; single crystal; 0.125 in. in dia and ~1.5 in. long; same preparation method as above; electrical resistivity 0.0021 ohm cm at room temperature.
5	274	L	1954	2.2-95		Ge 1	High-purity; single crystal; 1 cm long and 1.2 x 0.6 mm cross section; electrical resistivity at room temperature 60 ohm cm.
6	343	L	1956	2.8-137		Ge 3a	High-purity; p-type; polycrystalline.
7	343	L	1956	1.9-111		Ge 3b	The above specimen cleaned, annealed at 550 C for 3 hrs in helium, then cooled slowly.
8	344	L	1959	330-962		1	n-type single crystal; 0.4 cm^2 in cross sectional area and 0.3 cm long; electrical resistivity 3 ohm cm at 293 K.
9	344	L	1959	319-962		2	Similar to the above specimen except electrical resistivity 0.05 ohm cm at 293 K.
10	344	L	1959	331-1094		3	Similar to the above specimen except 0.8 cm long and electrical resistivity 0.03 ohm cm at 293 K.
11	344	L	1959	324-1040		4	Similar to the above specimen except 0.3 cm long and electrical resistivity 0.001 ohm cm at 293 K.
12	345	L	1957	87-293	3-8	1	Sb-doped; n-type single crystal; 2.035 x 0.231 x 0.417 cm; electrical resistivity 2.84 ohm cm at room temperature.
13	345	L	1957	91-307	3-8	2	Sb-doped; n-type single crystal; 1.800 x 0.228 x 0.294 cm; electrical resistivity 6×10^{-3} ohm cm at room temperature.
14	345	L	1957	88-300	3-8	8	Sb-doped; p-type single crystal; thermally converted from the above specimen 2; 1.675 x 0.212 x 0.250 cm; electrical resistivity 1.6 ohm cm at room temperature.
15	345	L	1957	89-311	3-8	3	Sb-doped; n-type single crystal; dimensions 1.875 x 0.262 x 0.329 cm; electrical resistivity 40 ohm cm at room temperature.
16	345	L	1957	94-311	3-8	4	Ga-doped; p-type single crystal; dimensions 2.000 x 0.336 x 0.285 cm; electrical resistivity 68 ohm cm at room temperature.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
17	345	L	1957	96-305	3-8	5	Ga-doped p-type single crystal; dimensions 1.450 x 0.215 x 0.330 cm; electrical resistivity 51 ohm cm at room temperature.
18	345	L	1957	208-260	3-8	6	Ga-doped p-type single crystal; dimensions 2.205 x 0.295 x 0.503 cm; electrical resistivity 5 ohm cm at room temperature.
19	345	L	1957	90-306	3-8	7	Ga-doped p-type single crystal; 2.13 cm long, 0.062 cm^2 cross sectional area; electrical resistivity 3 x 10^{-3} ohm cm at room temperature.
20	346	L	1959	388-971			Single crystal; intrinsic; 18 mm dia x 20 mm long.
21	346	L	1959	405-971			p-type; single crystal; 18 mm in dia x 20 mm long; impurity concentration 1.1 x 10^{18} cm^{-3}.
22	347		1958	76-370			p-type; single crystal; crystallographic orientation [111]; heat treated at 500 C for 32 hrs.
23	348	C	1959	368-758			n-type; single crystal; oriented in the [100] direction; 30 mils dia x 100 mils long; measured in He atmosphere; Ni used as comparative material (data from Honda, Simidv, 1917).
24	348	C	1959	354-1000			Similar to the above specimen but oriented in the [110] direction.
25	348	C	1959	370-775			Similar to the above specimen.
26	349	L	1958	293	4		Single crystal; impurity concentration 1.4 x 10^{15} cm^{-3}; approx 15 mm long and 16 mm in dia.
27	349	L	1958	293	4		Ga-doped p-type single crystal; impurity concentration 7.4 x 10^{17} atom cm^{-3}; approx 15 mm long and 16 mm in dia.
28	349	L	1958	293	4		Fe-doped n-type single crystal; impurity concentration 4.1 x 10^{17} atom cm^{-3}; approx 15 mm long and 16 mm in dia.
29	349	L	1958	293	4		Ga-doped p-type single crystal; impurity concentration 4.1 x 10^{16} atom cm^{-3}; approx 15 mm long and 16 mm in dia.
30	349	L	1958	293	4		Fe-doped n-type single crystal; impurity concentration 2.2 x 10^{16} atom cm^{-3}; approx 15 mm long and 16 mm in dia.
31	349	L	1958	293	4		Ga-doped p-type single crystal; impurity concentration 8.8 x 10^{16} atom cm^{-3}; approx 15 mm long and 16 mm in dia.
32	349	L	1958	293	4		Fe-doped n-type single crystal; impurity concentration 7.5 x 10^{16} atom cm^{-3}; approx 15 mm long and 16 mm in dia.
33	350	L	1953	56-91		A18-4-1	Al-doped p-type single crystal; cut transverse to the axis of crystal growth; electrical resistivity 0.2 ohm cm at room temperature.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
34	350	L	1953	65-81		Sb-7	Sb-doped n-type single crystal; specimen parallel to the [110] direction; cut transverse to the axis of crystal growth; electrical resistivity 0.013 ohm cm at room temperature.
35	351		1954	283	5-8		Pure crystal.
36	352	L	1957	2.0-100		Ga-2	Ga-doped p-type single crystal; 3.2 x 3.6 x 25 mm; cut transverse to the crystal growth axis; electrical resistivity 6.9 and 7.84 milliohm cm at 10 K and room temperature, respectively.
37	352	L	1957	2.0-100		Ga-2	The above specimen irradiated in Argonne CP-5 reactor with fast neutrons (total flux 5 x 10^{16} neutrons cm^{-2}) then kept at room temperature for about 5 months; electrical resistivity 6.4 and 7.657 milliohm cm at room temperature, respectively.
38	353	L	1958	1.5-120		PN-3E	Ga-Sb-doped p-type single crystal; data derived from the measurement of three specimens.
39	354	L	1957	2.2-280		Ge 2	n-type single crystal; carrier concentration 10^{13} cm^{-3}; specimen cross section 2.53 x 2.68 mm; zone grown; electrical resistivity at room temperature approx 39 ohm cm; heat flow parallel to the [100] direction.
40	354	L	1957	2.1-31		Ge 3	In-doped p-type single crystal; carrier concentration 10^{14} cm^{-3}; specimen cross section 2.56 x 2.65 mm; grown by zone melting; electrical resistivity 37 ohm cm at room temperature; heat flow parallel to [111] direction.
41	354	L	1957	2.9-84		Ge 4	In-doped p-type single crystal; carrier concentration 1.9 x 10^{14} cm^{-3}; specimen cross section 2.65 x 2.66 mm; grown by zone melting; electrical resistivity ~21 ohm cm at room temperature; heat flow parallel to [111] direction.
42	354	L	1957	2.2-78		Ge 5	n-type single crystal; carrier concentration 10^{12} cm^{-3}; specimen cross section 2.19 x 2.10 mm; pulled from melt, cut parallel to crystal growth direction; electrical resistivity approx 41 ohm cm at room temperature; heat flow parallel to [100] direction.
43	354	L	1957	2.0-97		Ge 7	In-doped p-type single crystal; carrier concentration 2.3 x 10^{16} cm^{-3} cross section 2.70 x 2.69 mm; grown by zone melting; electrical resistivity approx 0.19 ohm cm at room temperature; heat flow parallel to the [111] direction.
44	354	L	1957	2.2-80		Ge 10	In-doped p-type single crystal; carrier concentration 10^{15} cm^{-3}; specimen cross section 2.56 x 2.60 mm; grown by zone melting; electrical resistivity approx 2.75 ohm cm at room temperature; heat flow parallel to the [111] direction.
45	354	L	1957	2.0-100		Ge 11	Ga-doped p-type single crystal; carrier concentration 2 x 10^{18} cm^{-3}; specimen cross section 2.13 x 1.86 mm; pulled from melt, cut parallel to crystal growth direction; electrical resistivity approx 0.009 ohm cm at room temperature; heat flow parallel to the [100] direction.

SPECIFICATION TABLE NO. 14 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
46	354	L	1957	2.2-96		Ge 12	Ga-doped p-type single crystal; carrier concentration 10^{17} cm^{-3}; specimen cross section 2.06 x 1.95 mm; pulled from melt, cut parallel to crystal growth direction; electrical resistivity approx 0.0027 ohm cm at room temperature; heat flow parallel to the [100] direction.
47	355	L	1955	3.3-155	1-5	Ge 1	p-type single crystal; specimen 2 x 4 mm cross section, 5 mm long; electrical resistivity 31 ohm cm at 22 C.
48	779	L	1958	3.0-25		Normal Ge	n-type single crystal.
49	779	L	1958	2.1-290		Enriched Ge^{74}	Specimen composed of the following isotopes: 95.78 Ge^{74}, 0.728 Ge^{70}, 1.10 Ge^{72}, 1.54 Ge^{73} and 0.840 Ge^{76}; supplied by Union Carbide Nuclear Co.; 1.2 x 10^{13} excess donor atoms cm^{-3}; 2.54 cm long, 0.13 x 0.157 cm cross section; zone refined, grown using a modified Teal Little crystal puller; heat flow parallel to the [100] direction.
50	578	C	1960	311-683			n-type; electrical resistivity approx 5 ohm cm (inhomogeneous, electrical resistivity, especially high at center); F.H. stainless steel used as the reference (data on F.H. stainless steel from R.W. Powell 1936).
51	263	L	1958	300		T-1097	Sb-doped n-type; polycrystalline; specimen dimensions 5 x 5 x 15 mm; electrical resistivity 10.0 ohm cm at 300 K; measured in a vacuum of approx 10^{-6} mm Hg.
52	780, 684	L	1960	3.2-300	±5		Cu-doped p-type single crystal; (approx 10^{14} atoms cm^{-3}); dimensions 0.94 x 0.94 x 3.2 cm; dislocation density 3 x 10^{3} cm^{-2}.
53	780	R	1960	300-1020	±5		Very pure; n-type polycrystalline; crystal size approx 0.2 cm; specimen 1.27 cm in dia 6.1 cm long; zone refined, ground and cut to desired size; electrical resistivity 30 ohm cm at 300 K; average crystallite size 0.2 cm.
54	781, 684	R	1963	398-1194	±5		Intrinsic Ge; carrier concentration 2 x 10^{12} cm^{-3}; doped by copper during measurement to give 5 x 10^{15} acceptors cm^{-3}; cylindrical specimen approx 2.6 cm dia x 13 cm long made from single crystal grown by Czochralskii's method from zone refined germanium of the G. E. Co.; specimen aligned in the [100] crystalline direction; electrical resistivity before thermal conductivity measurement 46.6 ohm cm at room temperature changed to 4.6 ohm cm after the measurement.
55	626	P	1960	308-1073	±2		As-doped n-type single crystal; 2 in. long, cross section 0.3 x 0.3 in., heat flow and rod axis parallel to [111] direction; electrical resistivity at room temp. 0.3 ohm cm; thermal conductivity values calculated from measured thermal diffusivity data and the specific heat value of 1.83 J $cm^{-3}K^{-1}$ (derived from Dulong-Petit' law).
56	782		1957	16			Very pure; single crystal; 14.80 mm^2 cross section; polished.
57	783	L	1960	112-429		Sample 1	p-type; crystal obtained by Czochralskii method; cross sectional area, 0.53 x 0.32 cm^2; sand blasted; electrical resistivity ρ at room temperature 60 ohm cm; data corrected for radiation.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
58	783	L	1960	83-455		Sample 1A	Similar to the above specimen except cross sectional area 0.45 x 0.25 cm^2, produced from specimen 1 by grinding away a side.
59	783	L	1960	108-460		Sample 2	Similar to the above specimen except cross sectional area 0.74 x 0.55 cm^2, ρ = 21 ohm cm at room temperature.
60	783	L	1960	109-461		Sample 3	n-type; crystal obtained by Czochralskii method; cross sectional area 0.39 x 0.63 cm^2; sand blasted ρ ~ 2 ohm cm at room temperature.
61	783	L	1960	106-451		Sample 4	Ga-doped p-type; obtained from zone melting; cross sectional area 0.72 x 0.87 cm^2. ρ = 0.049 ohm cm at room temperature.
62	783	L	1960	107-460		Sample 5	Sb-doped n-type; obtained from zone melting; cross sectional area 0.82 x 0.53 cm^2. ρ = 0.043 ohm cm at room temperature.
63	784	L	1962	1.2-98	6	Sb 30	Sb-doped single crystal; 12.217 x 3.211 x 1.5055 mm; from ingot grown by the Czochralskii technique with the growth axis in [110] direction; cut transversely to the ingot axis, ground to size with specimen axis ap[illegible] [100] direction; carrier concentration n [illegible] 2.5 x 10^8 cm^{-3}; electrical r[illegible]y reported as 2.691, 2.70, 2.67, 2.65, 2.6, 2.846, 2.855, 2.87[illegible], 2.904, 2.919, 3.319, 3.386, 3.413, 3.441, 3.443, and 3.524 m[illegible] 1.234, 1.664, 2.004, 2.658, 4.128, 14.00, 14.78, 16.11, 17.98, 1[illegible], 20.22, 55.60, 68.44, 74.14, 84.93, 90.46, and 296 K, respectively.
64	784	L	1962	1.3-87	6	Sb 172	Sb-doped single crystal; 15.918 x 3.8221 x 3.7129 mm; same fabrication method as above; specimen axis approx in [111] direction; n = 6.1 x 10^{15} cm^{-3}; electrical resistivity reported as 2.15 x 10^6, 3.20 x 10^4, 3.22 x 10^3, 5.66 x 10^2, 63.22, 21.46, 4.311, 2.277, 2.058, 1.608, 1.115, 0.9610, 0.6570, 0.5448, 0.4587, 0.3685, 0.3099, 0.2309, 0.1557, 0.1075, 0.09557, 0.09040, 0.09343, 0.09512, 0.09708, 0.09931, 0.1052, 0.1252, 0.1812, 0.248, and 0.3988 ohm cm at 4.214, 5.139, 5.947, 6.763, 8.422, 9.690, 12.54, 14.22, 14.64, 15.45, 17.03, 17.82, 20.22, 21.76, 23.39, 26.02, 28.65, 34.06, 39.98, 47.13, 52.74, 62.13, 77.22, 81.32, 82.93, 97.20, 120.2, 166.6, 211.1, and 297.5 K, respectively.
65	784	L	1962	1.3-145	6	Sb 187	Sb-doped single crystal; 16.422 x 3.8906 x 4.0601 mm; same fabrication method as above; specimen axis approx in [100] direction; n = 1.2 x 10^{17} cm^{-3}; electrical resistivity reported as 182.4, 178.3, 172.8, 168.7, 163.6, 158.8, 155.8, 154.2, 152.8, 153.3, 154.1, 155.2, 151.0, 141.8, 132.4, 113.5, 98.69, 87.6, 79.16, 68.39, 55.54, 43.86, 37.13, 31.25, 24.55, 23.36, 22.51, 20.32, 18.81, 18.51, and 24.4 milliohm cm at 1.314, 1.436, 1.639, 1.835, 2.157, 2.582, 3.042, 3.451, 4.209, 5.981, 6.587, 8.208, 12.16, 14.12, 16.84, 20.23, 23.39, 25.71, 28.32, 31.46, 37.49, 45.16, 51.71, 60.13, 77.24, 82.12, 86.62, 102.6, 126.2, 141.5, and 296.9 K, respectively.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
66	794	L	1962	1.2-98	6	Sb 207	Sb-doped single crystal; 14.73 x 3.8975 x 3.9068 mm; same fabrication method and specimen axis orientation as above; n = 2.4 x 10^{16} cm^{-3}; electrical resistivity reported as 7.72 x 10^{5}, 1.63 x 10^{5}, 7.15 x 10^{4}, 3.40 x 10^{4}, 9.072 x 10^{3}, 1.371 x 10^{3}, 451, 179.2, 35.9, 12.49, 2.847, 1.331, 0.7778, 0.4815, 0.3191, 0.2570, 0.2143, 0.1702, 0.1400, 0.1049, 0.07895, 0.06426, 0.05369, 0.04743, 0.04187, 0.04091, 0.04066, 0.04180, 0.04372, 0.04692, and 0.09460 ohm cm at 2.140, 2.594, 3.016, 3.467, 4.214, 5.222, 5.935, 6.609, 8.194, 9.563, 12.21, 14.04, 15.84, 17.91, 20.21, 21.78, 23.28, 25.48, 27.72, 32.01, 38.06, 44.33, 52.17, 60.21, 77.36, 84.40, 99.69, 115.1, 128.9, 146.1, and 296.4 K, respectively.
67	794	L	1962	1.5-137	6	Sb 222	Sb-doped single crystal; 18.128 x 4.0751 x 4.0667 mm; same fabrication method and specimen axis orientation as above; n = 1.1 x 10^{18} cm^{-3}; electrical resistivity reported as 4.364, 4.372, 4.385, 4.404, 4.418, 4.430, 4.447, 4.466, 4.496, 4.523, 4.585, 4.642, 4.728, 4.786, 4.849, 4.891, 4.936, 5.020, 5.141, 5.268, 5.373, 5.453, 5.517, 5.479, 5.436, 5.378, 5.262, 5.075, 4.940, and 4.951 milliohm cm at 1.320, 1.579, 1.925, 2.587, 3.032, 3.422, 4.667, 5.624, 6.971, 8.256, 10.87, 13.14, 15.90, 17.97, 20.20, 21.75, 23.34, 26.15, 30.76, 36.27, 42.04, 48.21, 58.31, 77.28, 83.58, 92.17, 105.7, 128.9, 149.7, and 299.8 K, respectively.
68	794	L	1962	1.4-137	6	As 223 I	As-doped single crystal; 16.682 x 4.0939 x 4.0643 mm; same fabrication method and specimen axis orientation as above; n = 2.1 x 10^{16} cm^{-3}; electrical resistivity reported as 7.8 x 10^{6}, 2.7 x 10^{6}, 1.99 x 10^{3}, 343.1, 28.38, 6.263, 3.467, 1.367, 0.8056, 0.4880, 0.3521, 0.2527, 0.2079, 0.1640, 0.1160, 0.0943, 0.07229, 0.06290, 0.05490, 0.04620, 0.04479, 0.04337, 0.04363, 0.04350, 0.04893, and 0.09447 ohm cm at 4.208, 5.059, 7.378, 8.443, 10.77, 12.95, 13.96, 15.71, 18.04, 20.20, 21.59, 23.25, 25.93, 28.34, 32.92, 36.80, 43.40, 48.46, 55.44, 71.09, 77.17, 91.16, 104.7, 122.3, 142.0, and 293.9 K, respectively.
69	794	L	1962	1.5-125	6	As 223 II	As-doped single crystal; 15.938 x 3.8903 x 4.0643 mm; same fabrication method and specimen axis orientation as above; n = 6.3 x 10^{16} cm^{-3}; electrical resistivity 0.04178 ohm cm at room temperature.
70	794	L	1962	1.4-134	6	As 226	As-doped single crystal; 17.482 x 4.0612 x 3.8648 mm; same fabrication method and specimen axis orientation as above; n = 8.8 x 10^{17} cm^{-3}; electrical resistivity reported as 8.570, 8.577, 8.584, 8.592, 8.617, 8.642, 8.691, 8.800, 8.798, 8.764, 8.700, 8.582, 8.625, 8.749, 8.943, 9.120, 9.394, 9.606, 9.730, 9.872, 9.885, 9.730, 9.252, 9.014, 8.675, 8.225, 7.907, 7.590, and 6.568 milliohm cm at 1.346, 1.564, 1.751, 1.946, 2.384, 3.020, 3.507, 4.191, 4.927, 5.394, 5.855, 7.016, 7.996, 10.68, 14.32, 17.81, 23.29, 28.20, 32.11, 38.92, 49.48, 59.49, 77.15, 85.36, 95.98, 111.2, 123.5, 138.4, and 295.5 K, respectively.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
71	784	1	1962	1.4-4.2	6	As 232	As-doped single crystal; 19.812 x 3.8479, 4.034 mm; same fabrication method and specimen axis orientation as above; n = 3.1 x 10^{17} cm^{-3}; electrical resistivity reported as 0.8594, 0.7764, 0.7216, 0.6867, 0.6181, 0.5307, 0.4573, 0.3341, 0.2739, 0.02043, and 0.01467 ohm cm at 1.389, 1.533, 1.635, 1.764, 1.893, 2.205, 2.526, 3.451, 4.198, 77.2, and 296.5 K, respectively.
72	784	L	1962	1.3-139	6	As 233 I	As-doped single crystal; 17.308 x 4.0731 x 3.9978 mm; same fabrication method and specimen axis orientation as above; n = 1.1 x 10^{17} cm^{-3}; electrical resistivity reported as 1.92 x 10^6, 4.60 x 10^5, 1.69 x 10^5, 7.08 x 10^4, 2.238 x 10^4, 2.222 x 10^4, 2.189 x 10^4, 3408, 315.6, 104.2, 44.19, 16.65, 5.344, 2.647, 1.246, 0.7792, 0.4994, 0.3371, 0.2784, 0.2309, 0.1823, 0.1472, 0.1213, 0.08825, 0.06402, 0.05244, 0.04378, 0.03024, 0.02782, 0.02584, 0.02424, 0.02318, 0.02277, and 0.03129 ohm cm at 2.118, 2.598, 3.046, 3.513, 4.204, 4.206, 4.188, 5.132, 6.487, 7.315, 8.088, 9.144, 10.80, 12.18, 14.30, 15.93, 17.90, 20.28, 21.64, 23.12, 25.31, 27.69, 30.22, 35.90, 42.60, 48.56, 55.08, 76.52, 84.12, 94.16, 106.1, 122.9, 141.4, and 295.4 K, respectively.
73	784	1	1962	1.3-129		As 233 II	As-doped single crystal; 17.053 x 3.9504 x 4.0951 mm; same fabrication method and specimen axis orientation as above; n = 1.7 x 10^{17} cm^{-3}; electrical resistivity reported as 2.81 x 10^4, 1.856 x 10^4, 9742, 2845, 1045, 373.7, 154.4, 36.90, 14.15, 5.802, 1.966, 1.188, 0.9640, 0.5392, 0.3085, 0.2690, 0.2149, 0.1757, 0.1483, 0.1247, 0.1216, 0.1040, 0.09275, 0.06963, 0.05547, 0.04247, 0.03696, 0.03077, 0.02318, 0.02172, 0.02090, 0.01982, 0.01838, 0.01778, 0.01706, 0.01618, and 0.01977 ohm cm at 1.445, 1.578, 1.786, 2.171, 2.526, 2.946, 3.358, 4.202, 5.001, 5.914, 7.468, 8.479, 9.291, 10.84, 13.57, 14.34, 16.14, 18.16, 20.22, 21.61, 23.16, 25.74, 27.78, 33.47, 38.80, 46.49, 51.32, 59.03, 77.25, 82.08, 86.98, 93.10, 103.8, 109.3, 118.6, 132.7 and 297.0 K, respectively.
74	784	L	1962	1.3-76		SbGa 170	Doped with antimony and gallium; single crystal; 19.413 x 4.2278 x 3.7717 mm; same fabrication method and specimen axis orientation as above; n = 5.4 x 10^{16} cm^{-3}; electrical resistivity reported as 2.13 x 10^3, 1.65 x 10^3, 1.29 x 10^3, 1.03 x 10^3, 891, 685, 421, 346, 191.4, 124.0, 86.78, 56.26, 55.66, 41.60, 34.63, 29.32, 20.81, 15.59, 10.58, 8.182, 6.502, 4.978, 4.420, 4.125, 3.534, 3.095, 2.425, 1.884, 1.599, 1.162, 0.8203, 0.5025, and 0.1304 ohm cm at 1.303, 1.389, 1.486, 1.569, 1.637, 1.756, 2.017, 2.141, 2.589, 3.023, 3.475, 4.210, 4.229, 4.884, 5.358, 5.844, 7.091, 8.538, 11.23, 13.66, 16.44, 20.41, 22.42, 23.64, 26.52, 29.17, 34.26, 39.97, 43.96, 52.48, 63.04, 81.42, and 296.4 K, respectively.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
75	784	L	1962	1.3-148	6	SbGa 183	Doped with antimony and gallium; single crystal; 15.65 x 3.7364 x 3.6070 mm; same fabrication method and specimen axis orientation as above; n - 1.5 x 10^{17} cm^{-3}; electrical resistivity reported as 25.7, 21.24, 17.78, 14.54, 12.14, 9.619, 6.192, 4.578, 3.538, 2.835, 2.149, 1.750, 1.537, 1.245, 1.038, 0.9525, 0.866 0.7876, 0.7180, 0.6489, 0.6039, 0.5136, 0.4304, 0.3877, 0.3183, 0.2497, 0.2110, 0.1684, 0.1597, 0.1291, 0.1177, and 0.06187 ohm cm at 1.269, 1.368, 1.487, 1.634, 1.781, 2.022, 2.596, 3.511, 4.206, 5.212, 6.792, 8.398, 9.787, 12.55, 15.94, 17.99, 20.32, 25.16, 26.21, 29.85, 32.83, 39.78, 47.47, 52.55, 62.58, 77.18, 87.21, 108.8, 123.9, 141.9, 161.6, and 296.2 K, respectively.
76	784	L	1962	1.4-151	6	SbGa 204	Doped with antimony and gallium; single crystal; 16.822 x 3.913 x 3.924 mm; same fabrication method and specimen axis orientation as above; n - 2.6 x 10^{16} cm^{-3}; electrical resistivity reported as 1.19 x 10^5, 1.04 x 10^5, 6.82 x 10^4, 2.66 x 10^4, 1.27 x 10^4, 7.33 x 10^3, 3857, 3695, 2229, 1712, 1204, 682.2, 457, 241, 171, 120, 80.00, 70.41, 61.69, 51.53, 40.24, 31.79, 21.69, 15.13, 11.37, 7.597, 4.137, 3.777, 3.374, 2.822, 2.260, 1.853, 1.428, 1.161, 0.9402, and 0.4279 ohm cm at 1.934, 1.986, 2.141, 2.589, 3.062, 3.509, 4.201, 4.254, 4.939, 5.365, 6.039, 7.404, 8.655, 11.51, 13.67, 16.27, 20.24, 21.74, 23.32, 25.60, 28.94, 32.41, 33.52, 45.12, 50.76, 59.74, 77.08, 78.86, 84.13, 90.66, 99.63, 108.7, 122.7, 135.9, 152.1, and 293.8 K, respectively.
77	785	L	1962	1.3-4.2		1 N	Sb-doped n-type single crystal; dimensions approx 1 x 2 x 25 mm; specimen axis in [110] direction; lapped and etched; impurity concentration, n - 2 x $10^{?}$ cm^{-3}; electrical resistivity 0.13 ohm cm at 300 K.
78	785	L	1962	1.7-3.9		2 N	Similar to the above specimen except specimen axis in [111] direction and electrical resistivity 0.12 ohm cm at 300 K.
79	785	L	1962	1.7-4.1		3 N	Similar to the above specimen except specimen axis in [100] direction, n - 1 x 10^{16} cm^{-3}, and electrical resistivity 0.20 ohm cm at 300 K.
80	785	L	1962	2.0-4.0		4 N	As-doped single crystal; dimensions approx 1 x 2 x 25 mm; specimen axis in [110] direction; lapped and etched; n - 2 x 10^{16} cm^{-3}, electrical resistivity 0.12 ohm cm at 300 K.
81	785	L	1962	2.1-4.0		5 N	Pure; dimensions approx 1 x 2 x 25 mm; specimen axis in [111] direction; lapped and etched; electrical resistivity 31 ohm cm at 300 K.
82	785	L	1962	2.1-3.9		1 P	p-type; similar to the above specimen except specimen axis in [110] direction and electrical resistivity 47 ohm cm at 300 K.
83	786	L	1958	2.1-87	10-30		Pure germanium crystal; size approx 0.125 x 0.125 x 0.625 in.; provided by the Radio Corporation of America.
84	787, 751		1963	90-300			Germanium crystal; before neutron bombardment.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
85	787, 751		1963	90-300			The above specimen after a bombardment of 6 x 10^{17} neutron cm^{-2}.
86	787, 751		1963	86-270			The above specimen after a bombardment of 1.2 x 10^{18} neutron cm^{-2}.
87	752	P	1962	300-1075		Ge-1810	As-doped n-type single crystal; carrier concentration 5 x 10^{15} atoms cm^{-3}.
88	752	P	1962	317-1075		Ge-1796	Similar to the above specimen except carrier concentration 3 x 10^{19} atoms cm^{-3}.
89	752	P	1962	562-1136		Ge-5	Ga-doped p-type single crystal; carrier concentration 2.4 x 10^{19} atoms cm^{-3}.
90	1010	L	1957	18-94	2		n-type single crystal; specimen dimensions 1.5 x 1.8 x 15 mm; electron concentration approx 10^{14} cm^{-3}; heat flow parallel to [100] direction.
91	788	L	1963	1.3-82	30	CS	Sb-doped single crystal; supplied by Bell Telephone Laboratories; cut into an "L" shape; dimensions of legs approx 5 mm long, 1.2 x 1.2 mm cross section; one leg connected to heat sink (S leg), another leg connected to heater (H leg); S leg perpendicular to H leg; S leg axis aligned in the $\langle\bar{1}\bar{1}2\rangle$ direction; measurements made on S leg.
92	788	L	1963	1.3-85	30	CH	Data from measurements made on H leg of the above specimen.
93	788	L	1963	1.4-84	30	DS	Similar to the above specimen but with the H leg bent to a circular curvature of radius 3.35 cm; measurements made on the S leg.
94	788	L	1963	1.4-88	30	DH	Data from measurements made on the H leg.
95	789	L	1962	0.2-3.6	5	Ge 2	Same specimen as the one for curve 39.
96	789	L	1962	0.2-3.2	5	Ge 3	Same specimen as the one for curve 40.
97	789	L	1962	0.3-2.9	5	Ge 4	Same specimen as the one for curve 41.
98	789	L	1962	0.2-0.7	5	Ge 5	Same specimen as the one for curve 42.
99	789	L	1962	0.3-3.1	5	Ge 7	Same specimen as the one for curve 43.
100	789	L	1962	0.3-0.8	5	Ge 10	Same specimen as the one for curve 44.
101	789	L	1962	0.2-3.8	5	Ge 11	Same specimen as the one for curve 45.
102	789	L	1962	0.3-4.0	5	Ge 12	Same specimen as the one for curve 46.
103	339, 883	L	1955	5.1-281	< 10 in 4°-20°K and 100°-300°K; < 15 in 20°-100 K.		Sb-doped n-type single crystal, 2 x 4 x 15 mm; long dimension in the $\langle 111\rangle$ direction; obtained by Czochralski technique; electrical resistivity 0.10 ohm cm.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
104	339, 883, 988	L	1965	4.9-268	< 10 in 4°-20°K and 100°-300°K, < 15 in 20°-100°K.		Similar to the above specimen; irradiated at 30 C with a fast-neutron integrated flux of 1.1 x 10^{17} n cm^{-2}.
105	339, 883	L	1965	5.0-275	< 10 in 4°-20°K and 100°-300°K, < 15 in 20°-100°K.		Similar to the above specimen; irradiated at 30 C with a fast-neutron integrated flux of 2.5 x 10^{17} n cm^{-2}.
106	883	L	1957	5.1-287	< 10 in 4°-20°K and 100°-300°K, < 15 in 20°-100°K.		Similar to the above specimen; irradiated at 30 C with a fast neutron integrated flux of 1.7 x 10^{18} n cm^{-2}.
107	883	L	1957	5.4-500	< 10 in 4°-100°K and 100°-300°K, < 15 in 100°-300°K.		Similar to the above specimen; irradiated at 30 C with a fast-neutron integrated flux of 3.4 x 10^{20} n cm^{-2}.
108	884	L	1965	47-136		Ge II	High purity n-type single crystal; obtained from Eagle-Picher Company; bar shaped, 0.153 cm wide, 0.048 cm thick; long dimension in the < 110 > direction; irradiated (base temperature near 47 K, tip temperature < 70 K) for a length of 1 cm in < 111 > direction with a total electron flux of 1.01 x 10^{18} 2-Mev e cm^{-2}; annealed for 15 min at 175 K; electrical resistivity 50 ohm cm, carrier concentration approx 10^{14} cm^{-3}; measured on warming in the dark from 47 K after the electron traps were filled by a white-light illumination at 47 K.
109	884	L	1965	18-310		Ge I	High purity n-type single crystal; obtained from Eagle-Picher Company; bar shaped, 0.159 cm wide, 0.043 cm. thick; long dimension was the < 110 > direction; electrical resistivity 50 ohm cm; carrier concentration approx $10^{14} cm^{-3}$.
110	884	L	1965	20-31		Ge I	Same specimen as above; irradiated (base temperature near 20 K, tip temperature < 50 K) for a length of 1 cm in < 111 > direction with a total electron flux of 3.4 x 10^{18} 2-Mev e cm^{-2}; at 30 K for 15 min.
111	884	L	1965	20-61		Ge I	The above specimen annealed for the second time at 70 K for 15 min.
112	884	L	1965	19-150		Ge I	The above specimen annealed for the third time at 175 K for 15 min.
113	884	L	1965	18-65		Ge I	The above specimen annealed for the fourth time at 325 K for 15 min.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
114	884	L	1965	20-290		Ge I	The above specimen annealed for the fifth time at 405 K for 15 min.
115	884	L	1965	11-298		Ge II	High purity n-type single crystal; obtained from Eagle-Picher Company; bar shaped, 0.153 cm wide, 0.048 cm thick; long dimension in the <$1\bar{1}0$> direction; electrical resistivity 50 ohm cm; carrier concentration approx 10^{14} cm^{-3}.
116	884	L	1965	11-74		Ge II	Same specimen as above; irradiated (base temperature near 47 K, tip temperature < 70 K) for a length of 1 cm in <111> direction with a total electron flux of 1.01 x 10^{18} 2-Mev e cm^{-2}; annealed at 77 K for 15 min.
117	884	L	1965	11-118		Ge II	The above specimen annealed for the second time at 125 K for 15 min
118	884	L	1965	11-131		Ge II	The above specimen annealed for the third time at 140 K for 15 min.
119	884	L	1965	11-171		Ge II	The above specimen annealed for the fourth time at 175 K for 15 min.
120	884	L	1965	11-150		Ge II	The above specimen annealed for the fifth time at 209 K for 15 min.
121	884	L	1965	11-202		Ge II	The above specimen annealed for the sixth time at 230 K for 15 min.
122	884	L	1965	10-303		Ge II	The above specimen annealed for the seventh time at 405 K for 15 min.
123	885		1964	92-300		A	Single crystal.
124	885		1964	89-301		B	Single crystal; irradiated at 70 C for a fast neutron flux of 6 x 10^{15} n cm^{-2}.
125	885		1964	90-271		C	Similar to the above specimen except irradiated at 70 C by a fast neutron flux of 1.2 x 10^{15} n cm^{-2}.
126	887, 886		1964	300			Ga-doped p-type single crystal; carrier concentration 1.29 x 10^{14} cm^{-3}.
127	887, 886		1964	300			Ga-doped p-type single crystal; carrier concentration 1.70 x 10^{19} cm^{-3}.
128	887, 886		1964	300			Ga-doped p-type single crystal; carrier concentration 7.76 x 10^{19} cm^{-3}.
129	887, 886		1964	300			Ga-doped p-type single crystal; carrier concentration 1.12 x 10^{20} cm^{-3}.
130	887, 886		1964	300			As-doped n-type single crystal; carrier concentration 4.07 x 10^{15} cm^{-3}.
131	887, 886		1964	300			As-doped n-type single crystal; carrier concentration 4.37 x 10^{16} cm^{-3}.
132	887, 886		1964	300			As-doped n-type single crystal; carrier concentration 9.77 x 10^{16} cm^{-3}.

SPECIFICATION TABLE NO. 18 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
133	887, 886		1964	300			As-doped n-type single crystal; carrier concentration 3.24 x 10^{17} cm^{-3}.
134	887, 886		1964	300			As-doped n-type single crystal; carrier concentration 1.02 x 10^{19} cm^{-3}.
135	887, 886		1964	300			As-doped n-type single crystal; carrier concentration 1.51 x 10^{19} cm^{-3}.
136	887, 886		1964	300			As-doped n-type single crystal; carrier concentration 6.03 x 10^{19} cm^{-3}.
137	888, 889	L	1962	110-317		I 1	Sb-doped n-type single crystal; electrical resistivity 0.0205 - 0.0227 ohm cm at 300 K.
138	888, 889	L	1962	108-304		I 2	Similar to the above specimen.
139	888, 889	L	1962	142-308		I 3	Similar to the above specimen.
140	888, 889	L	1962	121-306		I 4	Ga-doped p-type single crystal; electrical resistivity 0.154-0.155 ohm cm at 300 K.
141	888, 889	L	1962	98-316		I 5	Similar to the above specimen.
142	888, 889	L	1962	122-312		I 6	Similar to the above specimen.
143	888, 889	L	1962	109-307		II 1	Sb-doped n-type single crystal; electrical resistivity 13.9-15.1 ohm cm at 300 K.
144	888, 889	L	1962	118-302		II 2	Similar to the above specimen.
145	888, 889	L	1962	114-304		II 3	Ga-doped p-type single crystal; electrical resistivity 25.4-26.0 ohm cm at 300 K.
146	888, 889	L	1962	131-310		II 4	Similar to the above specimen.
147	868, 889	L	1962	128-306		II 5	Similar to the above specimen.

DATA TABLE NO. 18 THERMAL CONDUCTIVITY OF GERMANIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
298	0.586
373	0.469
CURVE 2	
278.3	0.605
294.4	0.586*
308.7	0.566*
325.8	0.538*
346.5	0.515*
364.6	0.496
CURVE 3	
2.70	0.154
3.20	0.290
3.70	0.487
4.20	0.590
10.20	2.76
14.0	3.66
15.0	3.95
15.9	3.85
16.0	4.20
16.9	4.10
17.3	4.14
19.1	4.07
20.2	4.45*
20.3	3.91
20.5	3.95
20.6	3.11
63.5	2.97
66.0	2.55
70.0	2.60
75.0	2.27
79.0	2.21
CURVE 4	
2.72	0.0265*
3.59	0.0497
3.87	0.0581
4.00	0.0553

T	k
CURVE 4 (cont.)	
4.21	0.0688
14.5	0.998
15.8	1.140
18.1	1.300
19.7	1.44
20.4	1.65
63.6	1.90
67.2	1.82
68.0	1.90
69.0	1.76
70.0	1.72
78.0	1.62
86.0	1.70
CURVE 5	
2.23	0.314
2.56	0.433
3.00	0.610
3.60	0.942
4.48	1.620
5.48	2.375
6.21	3.02
7.23	3.91
8.75	4.94
9.90	5.70
11.0	6.39
12.1	6.85
13.5	7.29
15.0	7.85
18.5	8.21
22.3	8.11
26.8	7.85
30.4	7.60
33.5	7.12
40.6	6.52
72.8	3.55
95.2	2.50

T	k
CURVE 6	
2.80	1.17
3.26	1.68
3.78	2.39
4.42	3.19
5.89	6.50
6.65	6.97
6.75	6.48
6.90	7.29
7.81	8.44
8.26	9.04
9.26	10.2
9.92	10.7
11.21	11.3
12.56	12.2
14.04	12.5
15.35	12.4
18.04	12.4
19.5	12.1
22.5	10.9
25.1	10.3
27.6	9.71
32.1	8.74
39.9	7.30
57.4	4.43
63.4	3.97
71.4	3.42
79.3	2.93
91.8	2.43
102.6	2.10
118.8	1.72
137	1.49
CURVE 7	
1.88	0.400
2.26	0.654
2.80	1.09
3.39	1.76
4.28	2.79
7.88	7.56
8.83	8.48
12.03	10.4

T	k
CURVE 7 (cont.)	
16.1	11.4
21.7	10.4
26.8	9.05
32.9	7.96
33.3	7.76
67.9	3.41
78.7	2.79
90.9	2.30
110.7	1.73
CURVE 8	
328.9	0.464
347.2	0.455
354.6	0.403
396.8	0.384
507.6	0.351
609.8	0.277
781.3	0.195
806.5	0.204
869.6	0.207
961.5	0.204
CURVE 9	
318.5	0.489
354.6	0.474
398.4	0.375
588.2	0.276
617.3	0.244*
699.3	0.226
800.0	0.184
900.9	0.200
961.5	0.195
CURVE 10	
331.1	0.436
336.7	0.410
389.1	0.390
448.4	0.358
671.1	0.231

T	k
CURVE 10 (cont.)	
900.9	0.184
952.4	0.189*
1016.3	0.199
1050.4	0.216
1094.1	0.238
CURVE 11	
323.6	0.464
389.1	0.378
515.5	0.323
854.7	0.178
909.1	0.163
1000.0	0.171
1039.5	0.178
CURVE 12	
87	1.82
90	1.73
99	1.48*
103	1.43
111	1.33
119	1.21
127	1.13
140	1.02
215	0.682
234	0.636*
241	0.636
258	0.615
293	0.602
CURVE 13	
91	1.55
92	1.46
94	1.46*
95	1.46
98	1.38
101	1.38*
104	1.30
109	1.30

T	k
CURVE 13 (cont.)	
112	1.26*
119	1.17
122	1.13
196	0.741
203	0.711
209	0.690
221	0.686*
247	0.632
299	0.602*
302	0.615*
307	0.615
CURVE 14	
88	2.18
95	2.01
100	1.59
105	1.72
113	1.55
116	1.38
201	0.824
204	0.799
217	0.766
226	0.757
240	0.720
300	0.669
360	0.653
CURVE 15	
89	1.63
92	1.56*
93.5	1.52
94.5	1.45*
96	1.47
97.5	1.46
100	1.42
100	1.37*
104	1.38
106	1.29*
109	1.30*
113	1.27

T	k
CURVE 15 (cont.)	
120	1.18
124	1.13
196	0.728*
203	0.711*
211	0.686*
222	0.669*
246	0.623*
300	0.594*
311	0.565*
CURVE 16	
94	1.97
101	1.82
108	1.65
109	1.53
122	1.42
127	1.36
133	1.28
194	0.837
213	0.799
223	0.787
243	0.736
243	0.715*
250	0.720
256	0.707*
278	0.686*
292	0.674
298	0.669*
302	0.644*
311	0.628
CURVE 17*	
96	1.77
98	1.61
104	1.58
106	1.56
112	1.45
122	1.40
203	0.820
275	0.690
305	0.636

T	k
CURVE 18	
208	0.820
220	0.778
239	0.711
260	0.690
CURVE 19*	
90	1.39
93	1.41
114	1.23
116	1.23*
130	1.15
146	1.03
199	0.803
206	0.787
213	0.770
224	0.757*
306	0.669
CURVE 20	
387.6	0.494
404.9	0.481
409.6	0.473
427.4	0.444
510.2	0.398
520.8	0.371
574.7	0.348
675.7	0.324
757.6	0.364
769.2	0.389
787.4	0.388
813.0	0.385
840.3	0.354
862.1	0.359
862.1	0.375
917.4	0.363
970.9	0.381

*Not shown on plot

DATA TABLE NO. 18 (continued)

CURVE 21

T	k
404.9	0.463
411.5	0.444
421.9	0.435
495.0	0.400
497.5	0.387
561.9	0.363
584.8	0.349
598.8	0.345
632.9	0.345
662.3	0.346
714.3	0.350
757.6	0.354
819.7	0.361
862.1	0.367
934.6	0.385
970.9	0.392

CURVE 22

T	k
76	2.420
200	0.912
254	0.686
275	0.628
293	0.582
312	0.544
330	0.519
346	0.473
370	0.439

CURVE 23

T	k
367.6	0.461
400.0	0.395
425.5	0.326
454.5	0.298
476.2	0.276
495.0	0.252
520.8	0.238
571.4	0.220
598.8	0.200
684.9	0.171
729.9	0.162
757.6	0.152

CURVE 24

T	k
353.6	0.497*
357.1	0.493
370.4	0.492
381.6	0.525
393.7	0.430
408.2	0.421
416.7	0.401
425.5	0.381
438.6	0.352
446.4	0.342
454.5	0.312
465.1	0.302
500.0	0.270
520.8	0.241
552.5	0.231
552.5	0.210
606.1	0.192
833.3	0.151
909.1	0.140
1000.0	0.130

CURVE 25

T	k
370.4	0.433
377.3	0.401
390.6	0.371
408.1	0.351
416.7	0.327
425.5	0.304
434.8	0.291
444.4	0.273
454.5	0.263
476.2	0.248
500.0	0.234
526.3	0.220
571.4	0.199
625.0	0.198
680.2	0.175
719.4	0.166
775.1	0.154

CURVE 26

T	k
29[illegible].2	0.502

CURVE 27

T	k
293.2	0.155

CURVE 28

T	k
293.2	0.180

CURVE 29

T	k
293.2	0.234

CURVE 30

T	k
293.2	0.293

CURVE 31

T	k
293.2	0.192

CURVE 32

T	k
293.2	0.222

CURVE 33

T	k
56.0	5.18
57.0	4.66
60.2	4.15
60.9	4.25
67.3	3.43
69.5	3.33*
70.0	3.33
71.7	3.22
73.7	3.00
76.4	2.86
79.5	2.68
80.6	2.65

CURVE 34

T	k
64.6	3.39
65.2	3.20
65.6	3.18*
66.4	3.16
67.2	3.17

CURVE 34 (cont.)

T	k
67.2	2.97
68.2	3.07
69.0	3.01*
69.4	2.89
70.4	2.83*
71.1	2.78
72.1	2.73
72.6	2.80*
72.9	2.70*
73.2	2.79
73.5	2.68*
74.0	2.70
74.4	2.64
74.8	2.69
75.1	2.62
75.6	2.61
76.0	2.60
76.3	2.63
76.6	2.57
76.9	2.54
77.3	2.60
77.7	2.58*
78.6	2.47*
79.0	2.47
80.4	2.51
81.3	2.48

CURVE 35

T	k
283.2	0.586

CURVE 36

T	k
2.0	0.035*
3.0	0.076
4.0	0.190
5.0	0.355
6.0	0.56
7.0	0.82
8.0	1.09
9.0	1.35
10.0	1.65
15.0	3.00
20.0	3.90

CURVE 36 (cont.)

T	k
25.0	4.10
30.0	4.30
40.0	3.75
70.0	2.30
80.0	1.90
90.0	1.70
100.0	1.52

CURVE 37

T	k
2.0	0.0305*
3.0	0.063
4.0	0.165
5.0	0.330
6.0	0.530
7.0	0.750
8.0	1.000
9.0	1.20
10.0	1.50
15.0	3.00
20.0	3.8
25.0	4.10
30.0	3.70
40.0	2.60
50.0	2.35
60.0	2.30
70.0	2.05
80.0	1.80
90.0	1.65
100.0	1.50

CURVE 38

T	k
1.50	0.120
1.63	0.160
1.70	0.175
1.80	0.215
2.05	0.275
2.25	0.350
2.55	0.470
2.65	0.555
3.10	0.700
3.25	0.855
3.57	0.990

CURVE 38 (cont.)

T	k
4.50	1.30
5.40	1.85
6.70	3.00
7.50	3.50
9.35	5.10
10.5	5.50
11.5	6.50
11.5	7.10
13.0	6.75
15.5	8.10
17.0	8.50
20.0	8.80
2[illegible].0	9.70
22.0	9.20
23.4	[illegible].99
26.0	8.40
31.0	7.90
40.0	6.40
50.0	5.25
55.0	4.30
77.0	3.20
89.0	2.52
100.0	2.30
120.0	1.70

CURVE 39

T	k
2.15	1.09
2.30	1.30
2.35	1.37
2.50	1.60
2.80	2.00
3.15	2.50
3.20	2.78
3.50	3.24
3.75	3.75
4.00	4.10
4.50	5.00
4.55	5.15
5.50	7.00
6.40	8.35
7.30	10.00
7.90	10.50
8.85	11.60

CURVE 39 (cont.)

T	k
9.80	12.30
11.20	12.90
12.30	12.90
13.80	13.00
14.90	13.20
16.00	13.20
16.40	13.00
18.80	13.90
19.80	12.70
30.00	9.30
40.00	8.20
47.00	6.00
48.00	5.80
54.0	5.10*
63.0	4.25
75.0	3.55
81.0	2.98
130.0	1.50
157.0	1.18
204.0	0.90
225.0	0.80*
265.0	0.70
280.0	0.58

CURVE 40

T	k
2.05	0.498
2.10	0.570
2.52	0.935
3.05	1.51
5.23	4.50
6.70	6.40*
8.00	8.00
9.70	9.60
11.50	10.30
12.70	10.80
14.00	11.20
16.20	11.60
25.00	9.98
28.00	9.20
31.00	8.50

CURVE 41

T	k
2.00	0.475

CURVE 41 (cont.)

T	k
2.05	0.550
2.28	0.702
2.55	1.00
2.74	1.13
3.12	1.60
3.30	1.72*
3.70	2.24
3.85	2.46*
4.65	3.60
6.00	5.60
7.22	7.50
9.00	9.20
11.00	10.20
12.30	11.00
18.00	11.80
22.00	11.00
27.00	9.98
35.00	8.00
40.00	7.00*
68.00	4.00
84.00	2.85

CURVE 42

T	k
2.20	0.90
2.45	1.12
2.74	1.55
3.02	1.90*
3.52	2.55
3.80	3.05
4.02	3.55
4.65	4.55
5.40	6.00
6.30	7.26
6.60	7.70
7.30	8.80
7.60	9.10
9.20	10.70
10.70	11.80
12.00	12.00
13.15	12.60
17.80	12.40
22.00	11.90
26.00	10.60
30.00	9.40

* Not shown on plot

DATA TABLE NO. 18 (continued)

T	k
CURVE 42 (cont.)	
57.00	9.00
49.50	6.00
61.00	4.76
77.50	3.47
CURVE 43	
1.95	0.0395
2.00	0.0445
2.05	0.0510
2.10	0.0555
2.15	0.0620
2.25	0.0750
2.40	0.0980
2.55	0.130
2.60	0.142
2.78	0.180
2.90	0.212
3.00	0.249
3.03	0.280
3.20	0.330
3.50	0.430
3.85	0.645
4.05	0.800
4.48	1.07
4.50	1.10
4.55	1.20
5.50	1.92
6.00	2.45
6.50	2.90
7.00	3.50
7.50	3.98
8.00	4.55
9.00	5.30
10.0	6.02
11.3	7.15
12.0	7.50
13.0	7.90
14.5	8.40
15.3	8.90
17.5	9.10
18.0	9.20
20.0	9.10
21.5	8.98
25.0	8.30

T	k
CURVE 43 (cont.)	
28.0	8.00
32.0	7.40
40.0	7.00
42.2	6.10
50.0	5.20
55.5	5.00
58.0	4.70
68.0	3.80
88.0	3.00
97.0	2.72
CURVE 44	
2.22	0.602
2.30	0.650
2.30	0.675
2.65	0.860
2.95	1.20
3.00	1.55
3.50	1.97
4.02	2.80
4.40	3.20*
4.90	4.15
5.00	4.30
5.68	5.05
6.90	7.00
7.50	7.90*
7.80	8.40*
9.30	9.60
10.15	10.10
12.00	11.10
13.00	11.90
16.00	12.00*
18.00	12.00*
20.00	11.50*
22.50	10.80*
28.00	10.00
32.60	9.10
42.00	7.40*
50.00	6.00*
67.00	4.20
75.00	3.70*
80.00	2.75

T	k
CURVE 45	
1.98	0.0277
2.00	0.0215
2.02	0.0245
2.20	0.0277
2.30	0.0298
2.30	0.0340
2.45	0.0350
2.56	0.0415
2.58	0.0440
2.85	0.0525
2.97	0.0590
3.05	0.0650
3.20	0.0600
3.20	0.0755
3.30	0.0800
3.40	0.0850
3.52	0.0999
3.72	0.140
3.90	0.147
3.95	0.153
4.20	0.196
4.48	0.228
4.80	0.282
5.70	0.485
6.50	0.685
7.20	1.12
7.80	0.96
8.85	1.32
10.00	2.00
12.20	2.65
13.00	3.08
14.50	3.37
15.20	3.51
17.00	4.00
18.40	4.15
20.50	4.45
24.00	4.40
25.00	4.25
29.30	4.25
32.50	4.20
40.50	4.00
52.50	3.50
63.00	2.95
72.50	2.49
79.00	2.27

T	k
CURVE 45 (cont.)	
88.00	2.24
97.60	2.30
100.00	2.20
CURVE 46	
2.20	0.035
2.42	0.039
2.73	0.048
3.10	0.057
3.45	0.065
3.50	0.067
3.80	0.079
4.05	0.088
4.40	0.098
4.60	0.122
5.00	0.152
5.40	0.186
6.05	0.270
6.45	0.300
7.30	0.448
7.60	0.502
8.50	0.655
9.80	0.860
10.00	0.925
12.10	1.34
13.80	1.70
15.00	1.95
17.00	2.20
17.60	2.35
18.60	2.50
19.60	2.75
21.50	2.90
24.00	3.00
27.20	3.00
32.00	2.98
39.50	2.90
50.00	2.60
62.00	2.35
68.00	2.20
96.00	1.87
CURVE 47	
3.25	3.30

T	k
CURVE 47 (cont.)	
3.98	5.35
4.30	6.20
4.70	7.00
5.06	7.60
8.45	14.50
10.00	15.60
12.40	15.20
14.00	15.25
15.50	15.20
19.00	14.50
21.00	14.00
25.00	11.50
29.20	10.20
32.00	9.50
36.00	8.50
38.50	7.60
54.00	5.00
64.00	4.02
65.00	4.00
66.00	3.85
70.00	3.50
72.00	3.25
77.50	2.95
90.00	2.50
90.05	2.40
108.00	1.86
125.00	1.60
140.00	1.40
155.0	1.16
CURVE 48*	
3.0	1.0
3.2	1.4
3.5	1.7
4.4	3.0
5.0	3.6
5.5	4.5
6.0	4.9
6.5	5.5
8.0	7.2
9.0	8.7
10.5	9.5
11.5	10.5
12.5	11.3

T	k
CURVE 48* (cont.)	
14.5	11.3
17.5	10.5
21.0	11.2
25.0	10.0
CURVE 49	
2.1	0.82
2.8	1.4
3.0	1.9
3.8	3.4
4.2	4.6
5.0	6.8
5.7	10.5
6.8	12.5
7.8	18.0
8.6	25.0
9.6	27.0
13	33.0
15	38.0
17	37.8
21	37.8
24	33.0
29	29.0
33	24.0
48	13.0
60	8.4
66	6.4
70	5.6
76	4.9
82	4.0
90	3.8
110	2.7
150	1.7
205	1.1
220	1.05
280	0.82
CURVE 50*	
311.2	0.515
316.2	0.510
326.2	0.506
381.2	0.427
429.2	0.368

T	k
CURVE 50* (cont.)	
471.2	0.314
521.2	0.305
571.2	0.251
629.2	0.238
678.2	0.201
683.2	0.205
CURVE 51	
300	0.617
CURVE 52	
3.0	5.5
4.5	10.0
5.5	13.0
8.5	17.0
12.5	18.0
15.5	17.5
21.0	13.0
25.0	12.5
33.0	10.0
45.0	7.0
65.0	4.5
80.0	3.0
100.0	2.1
150.0	1.3
300.0	0.6
CURVE 53*	
300	0.600
350	0.500
350	0.480
370	0.490
370	0.450
370	0.390
420	0.380
430	0.370
470	0.375
540	0.349
580	0.280
630	0.245
670	0.225
710	0.215

T	k
CURVE 53* (cont.)	
790	0.190
840	0.190
880	0.170
920	0.155
965	0.170
1020	0.200
CURVE 54*	
398.4	0.421
399.0	0.428
399.0	0.423
448.9	0.381
489.5	0.351
491.6	0.337
524.1	0.316
540.5	0.327
551.7	0.290
571.2	0.287
577.9	0.278
632.5	0.252
684.6	0.235
686.6	0.217
763.8	0.208
768.5	0.197
818.0	0.189
853.2	0.183
879.0	0.178
903.2	0.178
946.6	0.177
956.4	0.174
1003.4	0.168
1015.4	0.175
1073.7	0.169
1134.9	0.170
1194.2	0.174
CURVE 55*	
308.2	0.599
373.2	0.488
473.2	0.368
573.2	0.286
673.2	0.233
773.2	0.198

*Not shown on plot

DATA TABLE NO. 18 (continued)

CURVE 55[*] (cont.)

T	k
873.2	0.179
973.2	0.171
1073.2	0.167

CURVE 56[*]

T	k
16	12

CURVE 57[*]

T	k
112	1.919
114	1.597
116	1.780
122	1.743
122	1.708
124	1.722
124	1.687
127	1.708
130	1.579
136	1.438
139	1.354
144	1.345
154	1.185
209	0.861
210	0.856
217	0.837
217	0.817
224	0.800
256	0.701
256	0.697
274	0.667
274	0.656
279	0.658
296.5	0.598
298.5	0.598
301	0.598
301	0.612
301	0.550
330	0.543
334	0.530
338	0.530
346	0.518
357	0.505
372	0.489
384	0.483

CURVE 57[*] (cont.)

T	k
389	0.478
398	0.470
407	0.463
428	0.448
429	0.445

CURVE 58[*]

T	k
83	2.827
86	2.827
90	2.827
90	2.735
94	2.476
97	2.324
100	2.179
105	2.092
106	2.031
113	1.851
120	1.666
298	0.608
298	0.589
300	0.591
300.5	0.588
302	0.590
304	0.588
387.5	0.462
393.5	0.462
396	0.462
396	0.460
397.5	0.462
402	0.457
403	0.452
424	0.431
426	0.434
426	0.429
429	0.431
433	0.425
434	0.428
440	0.426
446	0.426
446	0.423
446	0.416
455	0.422

CURVE 59[*]

T	k
108	1.835
114	1.714
118	1.609
124	1.585
127	1.634
127	1.585
127	1.555
136	1.404
148	1.308
150	1.260
154	1.324
210	0.922
226	0.832
236	0.784
244	0.750
303	0.617
303	0.599
306	0.597
312	0.580
312	0.575
329	0.540
333	0.535
336	0.532
337	0.536
349	0.515
366	0.495
381	0.479
414	0.447
426	0.444
440	0.436
460	0.422

CURVE 60[*]

T	k
109	1.573
112	1.597
120	1.494
120	1.458
127	1.332
132	1.291
136	1.282
137	1.268
144	1.192
206	0.792
207	0.781

CURVE 60[*] (cont.)

T	k
212	0.798
214	0.789
216	0.775
220	0.764
225	0.744
230	0.719
236	0.707
299	0.585
302	0.586
323	0.551
324	0.541
332	0.543
340	0.529
355	0.515
360	0.503
367	0.493
375	0.481
379.5	0.475
381	0.483
383	0.476
386	0.471
388	0.473
400	0.457
407	0.454
411	0.452
417	0.451
418	0.447
422	0.443
432	0.434
432	0.433
435	0.432
442	0.418
445	0.419
447	0.418
452	0.422
452	0.414
455	0.413
457	0.418
461	0.410

CURVE 61[*]

T	k
106	2.146
114	1.803
120	1.647

CURVE 61 (cont.)

T	k
122	1.628
134	1.538
136	1.505
142	1.524
208	0.910
226	0.820
236	0.755
319	0.588
310	0.568
314	0.567
372	0.474
387	0.452
390	0.451
398	0.440
411	0.439
412	0.430
430	0.420
435	0.409
440	0.410
442	0.411
451	0.398

CURVE 62

T	k
107	1.634
112	1.561
126	1.390
129	1.390
129	1.362
133	1.337
133	1.268
136	1.311
153	1.116
160	1.059
182	0.930
212	0.802
222	0.765
224	0.761
232	0.715
247	0.688
264	0.631
318	0.552
322	0.551
360	0.494
361	0.489

CURVE 62[*] (cont.)

T	k
366.5	0.484
371.5	0.479
373	0.477
378	0.466
385	0.463
394	0.457
394	0.455
394	0.454
400	0.442
406	0.438
413	0.438
425	0.422
428	0.414
429	0.418
431	0.414
436	0.411
438	0.406
441	0.407
442	0.404
447	0.402
450	0.397
460	0.388

CURVE 63

T	k
1.239	0.00183
1.330	0.00232
1.681	0.00695
2.062	0.0108
2.365	0.0185
2.802	0.0364
3.388	0.0718
3.804	0.118
4.469	0.212
7.117	0.678
12.07	2.28
15.40	2.90
15.49	3.50
16.29	3.43
17.24	3.60
18.69	3.59
20.99	4.07
22.46	3.83
23.84	3.70
26.30	3.76

CURVE 63 (cont.)

T	k
29.85	3.86
34.85	3.84
42.15	3.66
61.70	2.84
64.09	2.75
67.36	2.61
75.63	2.33
83.70	1.97
97.76	1.62

CURVE 64

T	k
1.302	0.0353
1.420	0.0599
1.714	0.132
2.038	0.286
2.213	0.301
2.242	0.345
2.472	0.507
2.846	0.826
2.871	1.09
3.513	1.56
4.677	2.34
5.358	3.54
5.684	3.81
8.043	5.44
11.60	9.57
13.02	8.75
14.37	9.68
15.00	10.1
16.05	9.20
17.86	8.78
18.46	8.31
20.75	9.26
21.17	7.77
27.24	8.04
29.93	7.33
31.04	5.94
41.12	5.38
53.77	4.39
67.91	3.36
78.89	2.72
87.32	2.13

CURVE 65

T	k
1.328	0.00474
1.475	0.00787
1.676	0.0133
1.935	0.0290
2.090	0.0363
2.263	0.0514
2.429	0.0749
2.519	0.0789
2.812	0.126
3.351	0.249
3.787	0.398
4.002	0.453
4.826	0.802[*]
4.831	0.802
5.545	1.18
6.559	1.78
7.126	2.17
8.092	2.56
9.718	3.11
15.51	4.55
17.00	5.02
21.32	5.70
21.69	5.74
26.83	5.11
29.26	5.84
32.53	5.68
37.78	5.47
42.60	4.98
50.51	4.44
60.10	3.89[*]
70.33	3.24[*]
76.88	3.01[*]
80.70	2.72[*]
98.71	2.15[*]
108.5	1.90[*]
114.2	1.80[*]
123.4	1.69[*]
134.5	1.50[*]
145.3	1.42[*]

CURVE 66[*]

T	k
1.496	0.0207
1.536	0.0272
1.766	0.0498

[*] Not shown on plot

DATA TABLE NO. 14 (continued)

T	k
CURVE 42 (cont.)	
37.00	9.00
49.50	6.00
61.90	4.76
77.50	3.47
CURVE 43	
1.95	0.0395*
2.00	0.0445*
2.05	0.0510
2.10	0.0555
2.15	0.0620
2.25	0.0750
2.40	0.0990
2.55	0.130
2.60	0.142
2.75	0.190
2.90	0.212
3.00	0.260
3.03	0.290
3.20	0.330
3.50	0.430
3.85	0.645
4.05	0.800
4.49	1.07
4.50	1.20
4.55	1.30
5.50	1.92
6.00	2.45
6.50	2.90
7.00	3.50
7.50	3.94
8.00	4.55
9.00	5.30
10.0	6.02
11.3	7.15
12.0	7.50
13.0	7.90
14.5	8.40
15.3	8.90
17.5	9.10
19.0	9.30
20.0	9.10
21.5	8.90
25.0	8.30

T	k
CURVE 43 (cont.)	
29.0	8.00
32.0	7.40
40.0	7.00
42.2	6.10*
50.0	5.20*
55.5	5.00*
56.0	4.70
60.0	3.90
90.0	3.00
97.0	2.72
CURVE 44	
2.22	0.482
2.30	0.650
2.30	0.675
2.65	0.900
2.95	1.30
3.00	1.55
3.50	1.97
4.02	2.90
4.49	3.20*
4.90	4.15
5.00	4.30
5.48	5.05
6.90	7.00
7.50	7.90*
7.90	8.40*
9.30	9.00
10.15	10.30
12.00	11.10*
13.00	11.90*
16.00	12.00*
15.90	12.00*
20.00	11.50*
22.50	10.80*
29.06	10.00
32.60	9.10
42.00	7.00*
50.00	6.00*
67.00	4.30
75.00	3.70*
88.00	2.75*

T	k
CURVE 45	
1.98	0.0277*
2.00	0.0215*
2.02	0.0245*
2.20	0.0277*
2.30	0.0299*
2.30	0.0340*
2.45	0.0350*
2.56	0.0415*
2.58	0.0400*
2.85	0.0525
2.97	0.0590
3.05	0.0654
3.28	0.0800
3.20	0.0755
3.30	0.0900
3.40	0.0850
3.52	0.0899
3.72	0.100
3.90	0.147
3.95	0.152
4.20	0.196
4.49	0.229
4.90	0.292
5.70	0.492
6.50	0.645
7.26	1.12
7.90	0.96
9.95	1.32
10.00	2.00
12.29	2.65
13.00	3.00
14.50	3.37
15.29	3.51
17.00	4.00
18.40	4.15
20.20	4.45
24.00	4.40
25.00	4.25
29.30	4.25
32.50	4.20
40.50	4.00
52.50	3.50
63.00	2.95
72.50	2.40
79.00	2.27

T	k
CURVE 45 (cont.)	
88.00	2.24
97.00	2.20
100.00	2.20
CURVE 46	
2.20	0.035*
2.42	0.039*
2.72	0.049*
3.20	0.052
3.45	0.065
3.50	0.067
3.90	0.079
4.05	0.090
4.49	0.090
4.60	0.122
5.00	0.152
5.40	0.196
6.05	0.270
6.45	0.300
7.20	0.440
7.60	0.500
8.50	0.655
9.90	0.800
10.40	0.925
12.30	1.24
13.40	1.70
15.00	1.95
17.00	2.20
17.60	2.35
18.60	2.50
19.60	2.75
21.50	2.90
24.00	3.00
27.20	3.00
32.00	2.90
38.50	2.90
50.90	2.60
62.00	2.35
69.00	2.20
90.00	1.97
CURVE 47	
3.25	3.30

T	k
CURVE 47 (cont.)	
3.94	5.35
4.20	6.29
4.70	7.00
5.00	7.65
8.45	14.50
10.00	15.00
12.40	15.26
14.00	15.25
15.50	15.20
19.00	14.50
22.00	14.00
25.00	11.50
30.20	10.20
37.00	9.50
36.00	8.50
39.50	7.60
54.00	5.00
64.00	4.05
65.00	4.00
66.00	3.95
70.00	3.50
72.00	3.25
77.50	2.95
90.00	2.50
90.05	2.00
100.00	1.96
122.60	1.00
140.00	1.00
152.0	1.18
CURVE 48*	
3.0	1.0
3.2	1.4
3.5	1.7
4.4	3.0
5.0	3.6
5.5	4.5
6.0	4.9
6.5	5.3
8.0	7.2
9.0	8.7
10.5	9.5
11.5	10.5
12.5	11.3

T	k
CURVE 48* (cont.)	
14.5	11.5
17.5	10.5
21.0	11.2
25.0	10.0
CURVE 49	
2.1	0.92
2.5	1.4
3.0	1.9
3.4	3.4
4.2	4.4
5.0	6.0
5.7	10.5
6.8	12.5
7.8	19.9
8.6	25.0
9.6	27.0
13	35.0
15	36.0
17	37.5
21	37.0
24	32.0
29	29.0
33	24.0
40	13.0
40	9.4
66	6.6
70	5.6
75	4.9
82	4.0
90	3.8
100	2.7
150	1.7
200	1.1
250	1.05
290	0.92
CURVE 50*	
311.2	0.512
336.2	0.510
326.2	0.506
391.2	0.457
429.2	0.369

T	k
CURVE 50* (cont.)	
472.2	0.314
521.2	0.305
571.2	0.251
629.2	0.239
679.2	0.231
682.2	0.205
CURVE 51*	
300	0.687
CURVE 52	
3.0	5.5
4.5	10.0
5.5	13.0
8.3	17.0
12.5	19.0
15.5	17.5
21.0	13.0*
25.0	12.5
33.0	10.0
43.0	7.0
63.0	4.5
90.0	3.0*
100.0	2.1*
150.0	1.3*
300.0	0.6*
CURVE 53*	
300	0.600
330	0.500
350	0.400
370	0.490
370	0.450
370	0.390
420	0.390
430	0.370
470	0.373
540	0.340
580	0.290
620	0.265
670	0.225
710	0.215

T	k
CURVE 53* (cont.)	
790	0.190
840	0.190
880	0.170
920	0.155
960	0.170
1020	0.200
CURVE 54*	
398.4	0.421
399.0	0.429
399.0	0.423
449.5	0.381
490.5	0.351
491.6	0.377
524.1	0.313
540.3	0.327
553.2	0.290
571.2	0.297
577.9	0.279
633.5	0.252
694.6	0.235
696.6	0.217
763.8	0.209
768.3	0.197
818.0	0.188
[illegible]	0.183
979.0	0.179
940.2	0.178
946.6	0.177
956.6	0.174
1003.4	0.168
1015.0	0.175
1073.7	0.169
1154.9	0.170
1194.2	0.174
CURVE 55*	
300.2	0.599
373.2	0.488
473.2	0.368
573.2	0.296
673.2	0.233
773.2	0.199

*Not shown on plot

DATA TABLE NO. [illegible] (continued)

T	k
CURVE 66 (cont.)	
1.821	0.0613
1.997	0.0967
2.180	0.140
2.421	0.218
2.842	0.383
3.370	0.802
3.805	1.11
4.150	1.51
4.846	2.20
5.574	2.66
12.15	7.82
14.87	6.94
18.27	7.37
20.85	7.89
20.93	7.14
28.94	6.87
30.22	6.69
35.18	5.51
40.81	5.19
49.92	4.68
61.87	3.86
76.40	3.05
79.80	2.81
95.36	2.34
100.4	2.22
114.2	1.92
127.8	1.64
141.2	1.50
CURVE 67*	
1.462	0.00431
1.575	0.0574
1.715	0.00823
1.922	0.0135
2.141	0.0301
2.186	0.0204
2.386	0.0274
2.640	0.0479
3.011	0.0679
3.405	0.112
3.909	0.187
4.667	0.327
5.051	0.399
5.847	0.670
6.943	1.00
CURVE 67* (cont.)	
7.996	1.28
10.99	2.78
12.11	2.92
15.15	3.73
17.35	4.20
21.50	4.40
22.16	4.28
25.31	5.22
26.87	4.74
27.53	4.78
30.99	4.48
35.60	4.05
38.59	4.13
43.50	3.89
53.48	3.44
64.18	2.92
78.46	2.39
94.75	1.9[illegible]
97.94	1.[illegible]
102.7	1.72
110.9	1.65
123.4	1.56
137.1	1.44
CURVE 68	
1.372	0.128
1.503	0.147
1.618	0.208
1.919	0.346
2.262	0.480
2.598	0.763
3.103	1.22
3.704	1.74
4.480	2.83
4.844	3.24
5.596	3.65
5.654	3.71
5.745	3.77
6.298	3.68
6.555	3.56
8.189	4.97
9.099	5.50
10.57	6.73
12.16	8.75
14.69	8.55
CURVE 68 (cont.)	
14.77	8.20
16.52	8.98
18.46	8.64
21.12	8.52
24.95	8.16
26.99	7.59
29.77	6.60
34.46	6.21
43.03	5.10
51.85	4.82
59.88	3.92
69.47	3.11
80.54	2.49
96.61	1.82
102.90	1.67
106.0	1.64
108.3	1.52
113.9	1.58
118.9	1.58
136.9	1.45
CURVE 69	
1.486	0.0780
1.718	0.116
1.938	0.156
2.284	0.236
2.434	0.279
2.701	0.364
2.901	0.417
3.116	0.530
3.419	0.618
3.803	0.775
4.569	1.03
5.066	1.29
5.674	1.65
6.207	1.68
6.949	2.25
8.193	2.55
9.152	3.19
9.849	3.22
11.21	3.46
14.79	4.50
15.22	4.82
15.68	5.34
17.25	5.76
CURVE 69 (cont.)	
17.55	5.90
18.89	5.93
21.99	6.26
23.15	5.60
25.17	6.21
27.51	5.70
30.10	6.20
32.05	5.99
36.62	5.82
46.00	5.34
55.67	4.30
66.57	3.60
73.81	2.94
81.89	2.96
96.37	2.64
101.0	2.36
112.1	2.00
125.1	1.80
CURVE 70*	
1.427	0.00451
1.501	0.00543
1.780	0.0114
1.788	0.0101
2.149	0.0199
2.446	0.0312
2.717	0.0445
3.024	0.0661
3.354	0.0980
3.761	0.141
4.209	0.211
4.732	0.298
5.342	0.429
5.800	0.534
6.752	0.791
7.718	1.02
8.761	1.26
10.27	1.45
15.30	2.40
16.29	2.53
16.92	2.73
18.95	3.20
22.32	3.26
30.56	3.45
33.87	3.33
CURVE 70* (cont.)	
33.15	3.08
38.59	3.07
41.91	3.39
47.59	3.02
54.85	2.75
70.24	2.38
79.37	2.03
86.95	2.00
95.23	1.68
97.95	1.68
110.4	1.41
122.4	1.25
134.2	1.28
CURVE 71	
1.436	0.00920
1.565	0.0122
1.676	0.0152
1.852	0.0223
2.008	0.0299
2.260	0.0468
2.392	0.0538
2.616	0.0736
2.834	0.0996
3.216	0.113
3.455	0.204
3.809	0.329
4.201	0.379
CURVE 72	
1.306	0.0283
1.339	0.0353
1.515	0.0471
1.748	0.0820
2.150	0.175
2.416	0.224
2.572	0.249
3.102	0.487
3.193	0.552
3.712	0.794
4.426	1.39
5.356	2.09
5.759	2.18
6.256	2.76
CURVE 72* (cont.)	
6.758	3.15
7.165	2.86
7.209	3.34
7.225	3.44
8.106	3.81
8.849	4.04
9.256	4.31
9.925	4.63
10.50	4.81
11.64	4.95
14.82	5.87
15.46	5.39
16.02	5.83
17.73	6.90
17.76	6.72
22.48	7.01
26.63	6.99
28.55	6.45
30.65	6.32
35.88	6.06
44.61	5.11
55.65	4.34
66.19	3.70
75.46	3.19
80.97	2.64
97.09	2.15
110.8	2.10
115.0	1.85
125.6	1.77
139.4	1.74
CURVE 73	
1.342	0.0143
1.456	0.0172
1.669	0.0270
1.940	0.0426
2.237	0.0646
2.629	0.106
3.254	0.192
3.926	0.279
4.779	0.393
5.178	0.501
5.463	0.508
6.296	0.809
6.782	0.918
CURVE 73* (cont.)	
8.192	1.49
10.09	2.15
12.70	3.08
13.77	3.45
14.88	2.70
15.81	3.41
17.50	3.82
19.51	4.15
22.33	4.78
24.64	4.73
27.62	4.90
30.16	4.66
32.84	4.87
36.62	5.05
41.30	4.70
41.97	5.11
46.10	4.29
52.33	3.93
63.84	3.34
82.20	2.64
98.39	2.23
104.8	2.10
115.4	1.78
129.1	1.69
CURVE 74*	
1.310	0.0097
1.460	0.0152
1.738	0.0348
2.075	0.0646
2.598	0.160
2.969	0.269
3.187	0.344
3.582	0.498
4.648	1.19
5.109	1.46
5.850	2.06
6.778	2.88
7.594	3.80
8.714	5.28
11.79	7.29
17.70	9.79
21.75	9.74
34.46	7.61
42.95	6.63

* Not shown on plot

DATA TABLE NO. 18 (continued)

T	k
CURVE 74* (cont.)	
49.54	3.59
59.45	4.41
73.44	3.11
CURVE 75	
1.324	0.00517
1.473	0.00771
1.620	0.0113
1.785	0.0172
2.147	0.0372
2.432	0.0610
2.944	0.130
3.382	0.192
4.208	0.385
5.593	0.794
6.430	1.10
7.068	1.43
7.835	1.78
8.590	1.91
9.975	2.17
11.31	2.48
12.32	2.66
13.30	3.40
16.04	3.16
16.74	3.74
18.62	4.18
18.65	4.20
20.24	4.03
24.35	4.65
31.30	4.66
33.67	4.68
37.98	4.24
40.04	4.15
50.01	4.14
65.32	3.35
75.78	2.59
83.61	2.39
88.41	2.26
93.99	2.15
103.9	1.81
114.3	1.62
119.0	1.60
133.4	1.46
148.9	1.31
CURVE 76*	
1.401	0.0267
1.494	0.0349
1.626	0.0487
1.859	0.0792
2.173	0.149
2.360	0.199
2.453	0.230
2.821	0.376
2.936	0.444
3.384	0.732
3.470	0.780
4.457	1.44
5.482	2.43
6.068	3.03
6.744	3.70
7.642	4.21
8.788	4.85
14.73	8.20
16.11	8.74
21.07	8.41
21.23	8.73
21.56	8.65
26.36	8.45
27.76	8.26
29.28	7.92
32.97	7.02
35.09	7.06
45.34	5.54
49.96	4.18
54.40	4.29
66.40	3.74
80.88	2.98
81.79	2.96
96.77	2.26
99.34	2.20
104.8	2.11
114.6	1.88
123.4	1.74
136.5	1.63
151.1	1.52
CURVE 77	
1.32	0.0180
1.40	0.0232
CURVE 77 (cont.)	
1.75	0.0680
1.92	0.0940
2.55	0.299
2.81	0.440
3.05	0.620
3.40	1.05
3.90	1.70
4.20	1.85
CURVE 78*	
1.70	0.056
1.95	0.098
2.12	0.150
2.30	0.184
2.40	0.245
2.69	0.362
2.82	0.485
3.25	0.785
3.90	1.640
CURVE 79*	
1.70	0.117
2.10	0.235
2.23	0.320
2.38	0.390
2.75	0.685
3.08	0.950
3.24	1.06
3.50	1.32
3.90	1.82
4.10	2.02
CURVE 80*	
1.97	0.540
2.33	0.830
2.68	1.175
3.00	1.520
3.25	1.700
3.60	2.060
3.75	2.350
3.95	2.600
4.00	2.750
CURVE 81	
2.11	1.05
2.11	1.08
2.32	1.40
2.51	1.72
2.75	1.96
2.80	2.08
2.90	2.10
2.95	2.12
2.97	2.15
3.00	2.43
3.06	2.30
3.15	2.55
3.30	2.56
3.50	3.19
3.85	3.62
4.00	3.75
CURVE 82	
2.05	1.02
2.27	1.28
2.60	1.70
2.85	2.17
3.10	2.40
3.31	2.85
3.50	3.31
3.67	3.40
3.85	3.70
CURVE 83*	
2.11	1.52
2.32	1.85
2.50	1.98
2.80	2.50
3.20	3.25
3.65	3.90
4.53	5.50
6.35	8.30
8.25	10.20
8.25	10.70
9.10	11.90
10.50	11.80
11.10	12.00
13.00	11.25
CURVE 83 (cont.)	
13.00	12.60
16.70	12.10
17.00	11.80
17.70	11.50
24.20	9.00
29.50	7.60
38.50	5.61
47.0	4.62
54.0	3.90
69.0	3.25
87.6	3.19
CURVE 84*	
90	2.50
91	2.60
92	2.40
95	2.40
98	2.25
100	2.30
101	2.15
110	2.00
120	1.70
128	1.66
140	1.45
160	1.20
210	0.90
260	0.72
300	0.60
CURVE 85*	
90	1.70
92	1.65
95	1.60
96	1.64
105	1.51
110	1.49
115	1.43
120	1.40
130	1.30
145	1.20
155	1.10
175	1.00
195	0.90
CURVE 85 (cont.)	
210	0.80
240	0.72
270	0.63
300	0.56
CURVE 86	
86	1.33
92	1.23
93	1.25
95	1.23
100	1.20
102	1.17
103	1.16
110	1.15
112	1.11
120	1.05
120	1.03
129	1.01
145	0.91
150	0.84
160	0.82
180	0.76
185	0.74
215	0.66
220	0.64
250	0.60
270	0.56
CURVE 87*	
300	0.535
469	0.342
493	0.337
538	0.303
578	0.286
625	0.258
633	0.249
676	0.241
690	0.236
741	0.213
752	0.216
752	0.205
752	0.211
781	0.206
CURVE 87* (cont.)	
813	0.197
870	0.189
926	0.182
943	0.175
971	0.175
990	0.176
1075	0.181
CURVE 88	
317	0.448
328	0.424
341	0.413
358	0.397
388	0.366
431	0.334
435	0.332
448	0.321
469	0.303
469	0.309
481	0.299
500	0.282
526	0.265
588	0.238
666	0.203
741	0.181
833	0.160
909	0.150
971	0.147
1075	0.146
CURVE 89	
562	0.268
633	0.236
752	0.196
885	0.165
971	0.165
1136	0.168
CURVE 90*	
18	12.4
21	12.0
50	5.1

* Not shown on plot

DATA TABLE NO. 18 (continued)

T	k
CURVE 90 (cont.)	
60	3.8
83	2.4
94	2.0
CURVE 91*	
1.26	0.0572
1.36	0.738
1.60	0.122
1.83	0.195
2.24	0.336
2.51	0.457
2.93	0.687
3.53	1.12
4.20	1.67
5.00	2.35
5.77	3.08
7.18	4.32
8.19	5.64
10.8	7.16
13.9	8.73
18.5	9.88
23.8	9.96
31.8	8.35
36.7	7.61
45.2	6.06
50.8	5.14
62.0	3.62
70.6	3.17
81.7	2.57
CURVE 92*	
1.27	0.0543
1.38	0.0726
1.62	0.121
1.82	0.181
2.28	0.349
2.54	0.483
2.98	0.726
3.58	1.15
4.29	1.67
5.10	2.36
5.90	2.97
7.30	4.52
8.85	5.29
11.1	6.68

T	k
CURVE 92* (cont.)	
14.2	8.02
19.2	8.87
25.0	8.40
33.5	7.35
38.7	6.47
47.6	5.38
53.3	4.82
65.4	3.92
74.7	2.96
84.7	2.55
CURVE 93*	
1.42	0.0633
1.61	0.0944
1.90	0.151
2.12	0.228
2.18	0.243
2.60	0.413
2.99	0.600
3.41	0.843
3.81	1.10
4.22	1.37
4.95	2.01
5.65	2.51
6.91	3.53
8.42	4.76
10.7	6.32
13.7	7.97
18.3	8.98
23.6	8.93
30.3	7.88
36.5	6.89
43.7	5.83
48.1	5.45
57.4	3.67
68.6	2.97
84.1	2.10
CURVE 94*	
1.44	0.0685
1.53	0.101
1.93	0.173
2.16	0.248
2.22	0.257
2.65	0.439

T	k
CURVE 94* (cont.)	
3.05	0.642
3.47	0.903
3.87	1.18
4.31	1.47
5.06	2.07
5.78	2.65
7.06	3.76
8.62	4.98
10.9	6.63
14.1	8.11
19.0	9.23
24.9	8.54
32.3	7.50
38.7	6.38
45.7	5.38
50.8	4.74
61.3	4.77
73.8	3.11
88.2	2.11
CURVE 95*	
0.215	0.00105
0.220	0.00107
0.230	0.00145
0.250	0.00185
0.250	0.00195
0.275	0.00290
0.300	0.00400
0.310	0.00380
0.320	0.00510
0.360	0.00600
0.380	0.0066
0.430	0.0105
0.430	0.0112
0.450	0.0118
0.495	0.0155
0.520	0.0180
0.630	0.0270
0.650	0.030
0.660	0.034
0.690	0.035
0.730	0.050
0.770	0.054
1.60	0.40
1.90	0.74
2.80	2.00

T	k
CURVE 95* (cont.)	
2.80	2.05
3.20	2.20
3.60	3.10
CURVE 96*	
0.22	0.00085
0.23	0.00092
0.28	0.0014
0.29	0.0015
0.30	0.0016
0.31	0.0017
0.33	0.00215
0.36	0.0027
0.36	0.0029
0.365	0.0034
0.400	0.0046
0.400	0.0050
0.45	0.0068
0.54	0.0108
0.56	0.0118
0.58	0.0100
0.58	0.0105
0.68	0.0200
0.97	0.0500
1.15	0.0800
2.65	1.00
3.20	1.55
CURVE 97*	
0.25	0.00145
0.26	0.00160
0.29	0.0022
0.32	0.00265
0.325	0.00330
0.325	0.00245
0.370	0.00490
0.400	0.0059
0.410	0.0066
0.460	0.0084
0.480	0.0090
0.500	0.0110
0.510	0.0120
0.530	0.0130
0.580	0.0125
0.720	0.0360

T	k
CURVE 97* (cont.)	
0.720	0.0380
0.820	0.044
0.860	0.055
1.05	0.084
1.10	0.115
1.20	0.125
1.45	0.200
1.70	0.310
1.90	0.680
2.00	0.520
2.15	0.850
2.40	1.05
2.90	1.10
CURVE 98	
0.215	0.00047
0.245	0.00074
0.250	0.00088
0.270	0.00100
0.320	0.0022
0.350	0.0027
0.440	0.0057
0.480	0.0063
0.530	0.0090
0.660	0.0120
0.700	0.0135
CURVE 99*	
0.29	0.00005
0.29	0.0000385
0.295	0.000058
0.31	0.000047
0.325	0.00007
0.34	0.00008
0.37	0.000101
0.37	0.000105
0.38	0.000125
0.46	0.00017
0.40	0.00014
0.44	0.000205
0.45	0.000215
0.46	0.00026
0.47	0.000285
0.49	0.00031
0.51	0.00040

T	k
CURVE 99* (cont.)	
0.51	0.00044
0.57	0.00046
1.40	0.0145
1.50	0.0200
1.85	0.041
1.90	0.045
2.35	0.110
2.50	0.125
3.10	0.285
CURVE 100*	
0.32	0.0012
0.32	0.00125
0.33	0.00135
0.34	0.00145
0.35	0.00155
0.44	0.00350
0.45	0.00520
0.60	0.011
0.72	0.017
0.73	0.0185
0.76	0.0205
CURVE 101*	
0.235	0.00026
0.25	0.00024
0.26	0.00031
0.26	0.00035
0.26	0.00052
0.27	0.00038
0.275	0.00046
0.29	0.00050
0.37	0.00105
0.385	0.0012
0.41	0.0017
0.44	0.00165
0.48	0.00175
0.52	0.0023
0.56	0.0026
0.62	0.0032
0.65	0.0031
0.67	0.0035
0.68	0.0042
0.74	0.0038
1.40	0.0155

T	k
CURVE 101* (cont.)	
1.55	0.0165
1.65	0.0150
2.40	0.031
2.50	0.040
3.50	0.082
3.70	0.087
3.80	0.105
CURVE 102*	
0.30	0.00085
0.32	0.00094
0.35	0.00115
0.36	0.00120
0.37	[illegible]
0.37	0.00170
0.40	0.00160
0.49	0.00260
0.50	0.00280
0.53	0.0036
0.55	0.00325
0.60	0.0039
0.64	0.0036
0.66	0.0041
0.70	0.0050
0.73	0.0056
0.77	0.0059
0.77	0.0051
1.55	0.0205
1.55	0.0225
1.85	0.026
2.40	0.0375
2.65	0.043
2.80	0.047
3.70	0.048
4.00	0.115
4.00	0.69
CURVE 103	
5.09	2.62
5.26	2.73
5.59	2.88
5.60	3.07
6.11	3.75
6.53	3.95
7.06	5.00

* Not shown on plot

DATA TABLE NO. 1[illegible] (continued)

CURVE 103 (cont.)

T	k
7.36	5.05
7.93	6.24
8.24	5.85
9.96	7.55
10.6	8.26
12.0	8.77*
14.7	10.1
15.7	10.4
16.8	10.5
19.4	10.5
21.2	10.2
25.1	9.75
29.7	8.55
37.0	7.71*
44.0	6.03*
56.6	4.54*
71.6	3.13*
94.2	2.22*
130.6	1.63*
160.0	1.36*
211.9	0.925*
280.6	0.682*

CURVE 104

T	k
4.90	0.245
5.46	0.331
5.70	0.326
6.28	0.454
7.05	0.540
7.98	0.706
8.77	0.759
8.93	0.815
9.86	0.908
11.2	1.07
12.4	1.32
13.5	1.36
15.3	1.61
18.2	1.85
19.7	1.95
20.2	2.06
24.6	2.31
27.5	2.44
29.2	2.33
32.7	2.52
36.8	2.33
39.5	2.57

CURVE 104 (cont.)

T	k
42.4	2.59
42.9	2.37
49.7	2.45
52.1	2.39
60.0	2.56
60.0	2.32*
73.5	2.12
94.2	1.90
111.4	1.57*
163.7	1.07
191.0	0.955
269.0	0.661

CURVE 105

T	k
5.00	0.111
6.12	0.200
7.11	0.275
9.77	0.443
11.2	0.560
15.4	0.638
17.6	1.05
22.4	1.21
26.8	1.37
31.2	1.44
43.4	1.48
66.4	1.52
99.6	1.24
123.6	1.12*
126.8	1.08*
163.3	0.852
195.9	0.804
274.8	0.604*

CURVE 106

T	k
5.06	0.0580
5.45	0.0662
5.29	0.0718
6.61	0.0881
8.00	0.113
8.93	0.128
9.98	0.144
13.2	0.204
16.2	0.263
20.1	0.317
24.3	0.407

CURVE 106 (cont.)

T	k
30.5	0.457
34.5	0.519
41.8	0.696
51.1	0.665
73.1	0.752
100.2	0.664
141.6	0.565
172.2	0.541
222.4	0.511
257.1	0.458

CURVE 107

T	k
5.37	0.0525
6.34	0.0601
6.47	0.0655
6.92	0.0716
7.43	0.0817
8.30	0.0867
9.14	0.104
9.64	0.109
9.98	0.106
12.7	0.140
14.8	0.163
20.6	0.231
28.0	0.334
35.2	0.410
40.7	0.444
51.5	0.506
60.7	0.526
67.3	0.611
82.4	0.573
124.5	0.548
237.2	0.452

CURVE 108*

T	k
47.0	2.72
50.6	2.64
55.2	2.56
60.2	2.42
65.0	2.31
70.5	2.15
75.2	2.05
80.4	1.96
85.3	1.85
90.3	1.83

CURVE 108 (cont.)*

T	k
95.4	1.73
100.5	1.64
110.2	1.46
119.9	1.38
135.5	1.26

CURVE 109*

T	k
18.4	4.10
38.7	4.20
46.3	3.56
49.1	3.40
57.0	2.75
74.5	1.93
85.9	1.56
123.6	1.04
200.0	0.665
296.5	0.509
309.7	0.533

CURVE 110

T	k
19.8	0.873
29.7	1.08
30.8	1.11

CURVE 111

T	k
19.5	0.873*
20.5	0.879
26.8	1.08
35.1	1.22
40.9	1.28
43.7	1.30
49.6	1.31
60.5	1.29

CURVE 112

T	k
19.1	1.49
20.0	1.45
20.4	1.46
21.8	1.65
22.4	1.66
24.9	1.80
29.5	1.91
34.7	1.94

CURVE 112 (cont.)

T	k
39.4	2.00
40.1	2.03
46.8	1.90
46.8	1.96*
55.1	1.79
70.5	1.55
90.0	1.26*
103.8	1.12
127.1	0.966
150.3	0.822

CURVE 113*

T	k
17.9	3.48
18.5	3.60
18.9	3.43
20.0	3.63
22.0	3.72
23.9	3.66
[illegible]	3.72
26.8	3.97
29.0	3.92
31.8	3.85
34.1	3.74
36.3	3.74
37.8	3.67
39.4	3.50
41.2	3.52
43.3	3.46
44.2	3.37
47.0	3.15
47.8	3.11
51.3	3.01
54.7	2.74
65.2	2.31

CURVE 114

T	k
20.4	4.47*
22.1	4.54
24.7	4.83
27.6	4.92
29.7	4.92
31.4	3.56
33.4	4.36
36.6	4.06
37.4	4.22

CURVE 114 (cont.)

T	k
41.0	4.00*
42.4	3.86
44.6	3.69
51.1	3.21
54.6	3.03
64.1	2.48
79.1	1.85*
179.1	0.735*
289.7	0.537*

CURVE 115*

T	k
10.8	4.39
13.7	4.86
15.6	5.20
15.8	4.96
17.0	5.39
18.2	5.69
18.9	5.64
19.6	5.70
20.0	5.81
21.2	5.51
22.0	5.90
23.6	5.72
24.9	5.42
26.2	5.29
27.3	5.49
28.4	5.56
29.2	5.40
30.0	5.49
31.8	5.32
32.6	5.15
35.2	4.97
37.3	4.83
38.4	4.83
41.9	4.83
48.0	4.33
52.7	3.77
57.8	3.62
66.7	3.16
77.1	2.57
86.7	2.35
100.7	1.86
125.6	1.43
187.1	0.962
241.5	0.777
298.0	0.670

CURVE 116

T	k
10.6	1.01*
10.7	1.04*
10.9	1.05*
11.2	1.07*
14.8	1.40
17.5	1.59
18.2	1.68
19.1	1.73
20.0	1.78
21.1	1.85
22.3	1.90
24.0	2.00
25.7	2.06
26.5	2.05
28.1	2.06
30.2	2.13
31.4	2.20
34.0	2.20
36.0	2.22
38.0	2.18
39.9	2.22
42.5	2.24
44.2	2.29
47.0	2.29
50.5	2.26
54.0	2.20
56.5	2.16
60.8	2.11
64.0	2.09
68.7	2.05
73.6	1.92

CURVE 117*

T	k
10.7	1.19
10.9	1.19
11.1	1.21
11.2	1.22
12.0	1.31
12.9	1.38
14.0	1.49
15.1	1.58
16.0	1.74
17.0	1.83
17.9	1.85
19.0	1.92
20.0	1.96

*Not shown on plot

DATA TABLE NO. 18 (continued)

T	k
CURVE 117 (cont.)*	
21.9	2.17
23.9	2.25
25.1	2.38
27.0	2.44
28.7	2.37
32.0	2.38
34.4	2.48
37.0	2.52
40.3	2.47
43.4	2.50
46.7	2.46
47.3	2.46
50.1	2.[illegible]
55.6	2.38
60.3	2.31
64.9	2.21
70.5	2.07
75.2	2.03
80.4	1.91
85.3	1.79
90.4	1.76
95.5	1.67
100.5	1.58
110.9	1.46
117.5	1.38
CURVE 118*	
11.0	1.44
11.1	1.43*
11.1	1.38
12.1	1.63
13.0	1.70
14.0	1.86
15.1	1.92
16.1	2.06
18.0	2.23
20.1	2.27
22.1	2.44
24.0	2.50
26.1	2.59
28.1	2.71
30.3	2.65
32.1	2.56*
33.1	2.80
35.3	2.83
37.3	2.84

T	k
CURVE 118 (cont.)	
39.5	2.85
41.3	2.83
43.5	2.82
46.9	2.83
48.4	2.70
50.4	2.63*
55.0	2.63
60.8	2.47
65.6	2.39*
70.3	2.28*
75.3	2.15*
80.5	2.07*
85.5	1.95*
90.6	1.92*
90.3	1.79*
100.5	1.67*
110.9	1.53*
131.2	1.23*
CURVE 119*	
11.0	1.54
11.1	1.62
11.2	1.56
11.3	1.56
12.1	1.71
13.0	1.82
14.0	1.91
15.6	2.20
17.1	2.44
19.1	2.47
19.6	2.59
20.1	2.50
22.0	2.65
23.9	2.75
26.1	2.92
28.1	3.03
30.2	3.01
32.4	3.08
33.8	2.96
35.5	2.91
38.3	3.13
40.4	3.05
42.4	2.98
44.5	2.93
46.8	3.08
50.7	3.06

T	k
CURVE 119 (cont.)*	
55.3	2.89
60.7	2.74
65.3	2.59
70.6	2.41
75.5	2.28
80.5	2.17
85.5	2.02
95.7	1.83
110.7	1.55
120.5	1.38
135.2	1.24
170.6	1.02
CURVE 120	
11.0	2.48
11.6	2.54
12.0	2.75
13.1	2.88
14.2	2.93
15.1	3.35
16.2	3.40
17.2	3.60
19.2	3.67
20.1	3.74*
21.9	3.89
24.3	3.85
26.7	3.73
28.2	3.69
30.1	3.79
32.1	3.73
34.2	3.78
36.3	3.74
38.3	3.87
40.5	3.78*
42.7	3.63*
43.4	3.67
45.4	3.58*
46.7	3.58
48.3	3.56*
50.1	3.48
55.7	3.20
60.8	2.93
65.5	2.74*
70.5	2.60*
75.5	2.41*
81.1	2.23*

T	k
CURVE 120 (cont.)	
85.1	2.17*
91.0	2.01*
110.7	1.63*
129.7	1.30*
150.3	1.16*
CURVE 121	
11.0	3.84
11.1	3.96
11.9	3.87
13.1	4.08
13.9	4.42
15.0	4.53*
16.1	5.16
17.1	5.10*
18.1	5.21
19.0	5.42
20.1	5.41
22.6	5.32
24.4	5.11
25.6	4.86
26.8	5.30
27.7	5.41
28.8	5.17
29.8	5.08
31.5	4.89
33.1	4.99
35.2	4.67
37.5	4.66
39.5	4.48
41.7	4.47
44.1	4.45
47.5	4.22
54.1	3.73
55.5	3.59
60.4	3.38
66.1	3.11*
70.6	2.83*
75.5	2.63*
77.6	2.51*
80.5	2.43*
85.1	2.31*
90.4	2.18*
100.2	1.93*
110.7	1.68*
120.8	1.51*

T	k
CURVE 121 (cont.)	
135.5	1.33*
151.7	1.19*
178.2	1.02*
202.3	0.885*
CURVE 122*	
10.1	3.79
10.3	3.86
10.6	3.86
10.6	3.98
12.2	3.98
13.0	4.30
14.1	4.70
15.0	4.59
16.0	5.03
17.3	5.15
18.0	5.35
19.1	5.23
19.9	5.72
22.1	5.41
24.2	5.65
26.2	5.59
28.1	5.46
30.0	5.45
31.9	5.10
35.3	5.05
38.7	4.78
39.4	4.88
40.3	4.73
42.3	4.73
43.6	4.63
45.9	4.51
47.4	4.42
48.2	4.42
50.4	4.32
55.9	3.95
60.5	3.67
65.9	3.28
70.6	3.11
75.5	2.79
80.9	2.59
86.1	2.42
89.5	2.28
95.9	2.09
100.7	1.97
111.9	1.75

T	k
CURVE 122 (cont.)	
120.8	1.56
136.5	1.38
151.7	1.22
166.7	1.12
181.6	1.02
201.8	0.925
225.9	0.838
252.3	0.775
278.0	0.723
302.7	0.681
CURVE 123*	
91.6	2.74
91.6	2.61
93.5	2.66
93.8	2.50
96.6	2.44
98.6	2.33
101.9	2.35
102.1	2.21
106.4	2.15
110.4	2.00
122.7	1.71
129.4	1.59
141.3	1.45
162.6	1.22
213.3	0.916
263.0	0.716
299.9	0.610
CURVE 124*	
89.3	1.73
92.5	1.72
94.2	1.66
96.8	1.65
97.1	1.60
105.4	1.52
109.6	1.49
118.3	1.41
123.6	1.39
132.7	1.29
145.5	1.18
159.6	1.10
180.7	0.995
200.4	0.893

T	k
CURVE 124 (cont.)*	
217.8	0.813
243.8	0.719
271.6	0.637
301.3	0.564
CURVE 125*	
90.0	1.33
94.0	1.25
96.2	1.21
97.5	1.25
100.5	1.20
100.7	1.25
102.6	1.19
103.8	1.16
110.4	1.16
113.5	1.12
117.8	1.09
120.2	1.05
128.2	1.02
143.5	0.923
155.2	0.843
162.6	0.820
180.3	0.757
182.8	0.736
248.3	0.586
271.0	0.548
CURVE 126*	
300	0.600
CURVE 127*	
300	0.464
CURVE 128	
300	0.421
CURVE 129	
300	0.391
CURVE 130*	
300	0.598

*Not shown on plot

DATA TABLE NO. 18 (continued)

T	k
CURVE 131*	
300	0.598
CURVE 132*	
300	0.582
CURVE 133*	
300	0.509
CURVE 134*	
300	0.346
CURVE 135	
300	0.272
CURVE 136*	
300	0.202
CURVE 137*	
110.3	1.87
117.1	1.70
127.7	1.49
317.1	0.556
CURVE 138*	
107.7	1.88
116.5	1.78
118.2	1.65
128.1	1.54
136.4	1.39
140.6	1.35
153.1	1.20
156.9	1.18
168.8	1.10
210.5	0.900
210.5	0.866
217.5	0.849
217.5	0.824
223.0	0.799
229.0	0.774
241.8	0.741

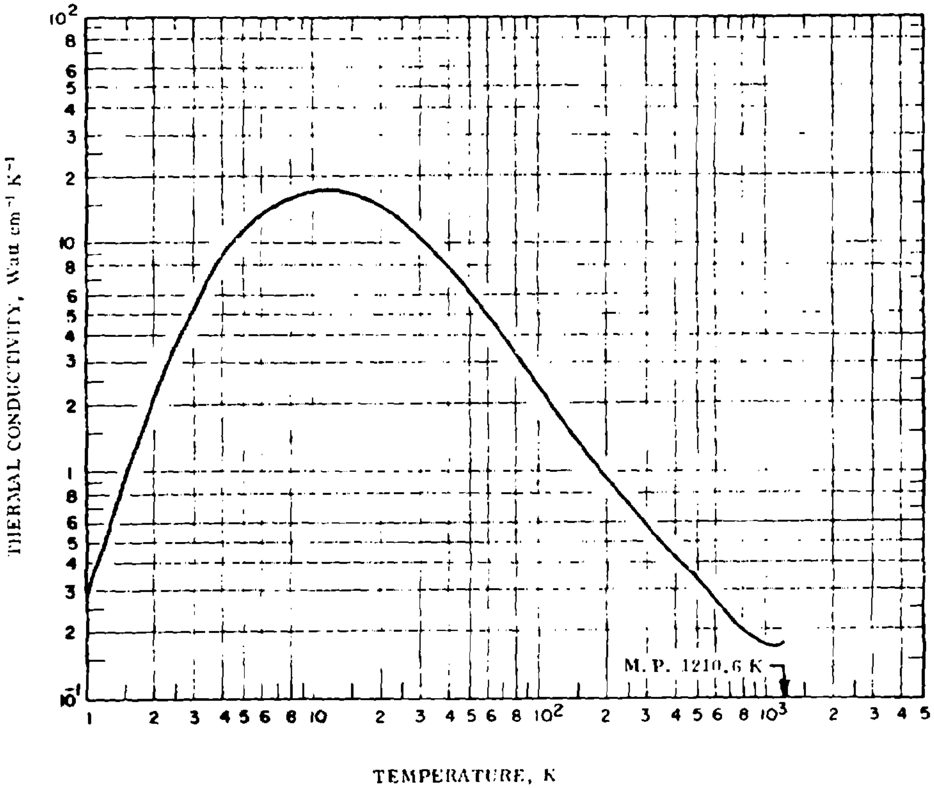
T	k
CURVE 138 (cont.)*	
300.5	0.598
305.7	0.590
313.5	0.565
CURVE 139*	
142.0	1.38
152.6	1.27
227.0	0.799
308.2	0.590
CURVE 140*	
121.4	1.67
132.7	1.48
143.6	1.36
151.6	1.23
206.9	0.904
220.3	0.849
227.0	0.828
301.4	0.619
305.5	0.619
CURVE 141*	
98.2	2.23
108.8	1.90
201.3	0.908
207.0	0.879
214.0	0.874
299.0	0.615
310.8	0.590
316.0	0.569
CURVE 142*	
121.9	1.62
123.4	1.56
142.4	1.33
146.4	1.28
162.5	1.14
311.8	0.561
CURVE 143*	
109.4	1.91
125.4	1.50

T	k
CURVE 143 (cont.)*	
126.2	1.52
127.2	1.55
127.8	1.53
129.6	1.55
136.6	1.36
302.0	0.573
307.4	0.573
CURVE 144*	
118.1	1.70
122.2	1.61
145.1	1.30
203.4	0.891
215.8	0.841
223.4	0.791
229.1	0.770
301.7	0.598
CURVE 145*	
113.8	1.77
125.9	1.54
140.9	1.36
159.0	1.19
170.9	1.09
206.4	0.874
213.5	0.849
221.6	0.816
231.3	0.778
304.3	0.577
CURVE 146*	
130.6	1.54
148.1	1.30
310.2	0.573
CURVE 147*	
128.4	1.57
131.9	1.51
135.6	1.45
143.8	1.35
166.4	1.17
209.9	0.874
218.4	0.854

T	k
CURVE 147 (cont.)*	
221.5	0.841
229.6	0.803
236.2	0.774
305.5	0.598

* Not shown on plot

FIGURE AND TABLE NO. 18R RECOMMENDED THERMAL CONDUCTIVITY OF GERMANIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.338	19.5	440.7
1	0.274	15.8	-457.9	600	0.273	15.8	620.7
2	2.06	119	-456.1	700	0.227	13.1	800.7
3	5.35	309	-454.3	800	0.198	11.4	980.7
4	8.77	507	-452.5	900	0.182	10.5	1160
5	11.6	670	-450.7	1000	0.174	10.1	1340
6	13.9	803	-448.9	1100	0.170	9.82	1520
7	15.5	896	-447.1	1200	0.174	10.1	1700
8	16.6	959	-445.3				
9	17.3	1000	-443.5				
10	17.7	1020	-441.7				
11	17.9	1030	-439.9				
12	18.0	1040	-438.1				
13	17.9	1030	-436.3				
14	17.7	1020	-434.5				
15	17.3	1000	-432.7				
16	16.9	976	-430.9				
18	15.9	919	-427.3				
20	14.9	861	-423.7				
25	12.7	734	-414.7				
30	10.8	624	-405.7				
35	9.20	532	-396.7				
40	7.98	461	-387.7				
45	6.95	402	-378.7				
50	6.15	355	-369.7				
60	4.87	281	-351.7				
70	3.93	227	-333.7				
80	3.25	188	-315.7				
90	2.70	156	-297.7				
100	2.32	134	-279.7				
150	1.32	76.3	-189.7				
200	0.968	55.9	- 99.7				
250	0.749	43.3	- 9.7				
273.2	0.667	38.5	32.0				
300	0.599	34.6	80.3				
350	0.495	28.6	170.3				
400	0.432	25.0	260.3				

REMARKS

The recommended values are for high-purity germanium. The values are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures above 40 K. The thermal conductivity near and below the corresponding temperature of its maximum is highly sensitive to small physical and chemical variations of the specimens, and the values below 40 K are intended as typical values for indicating the general trend.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

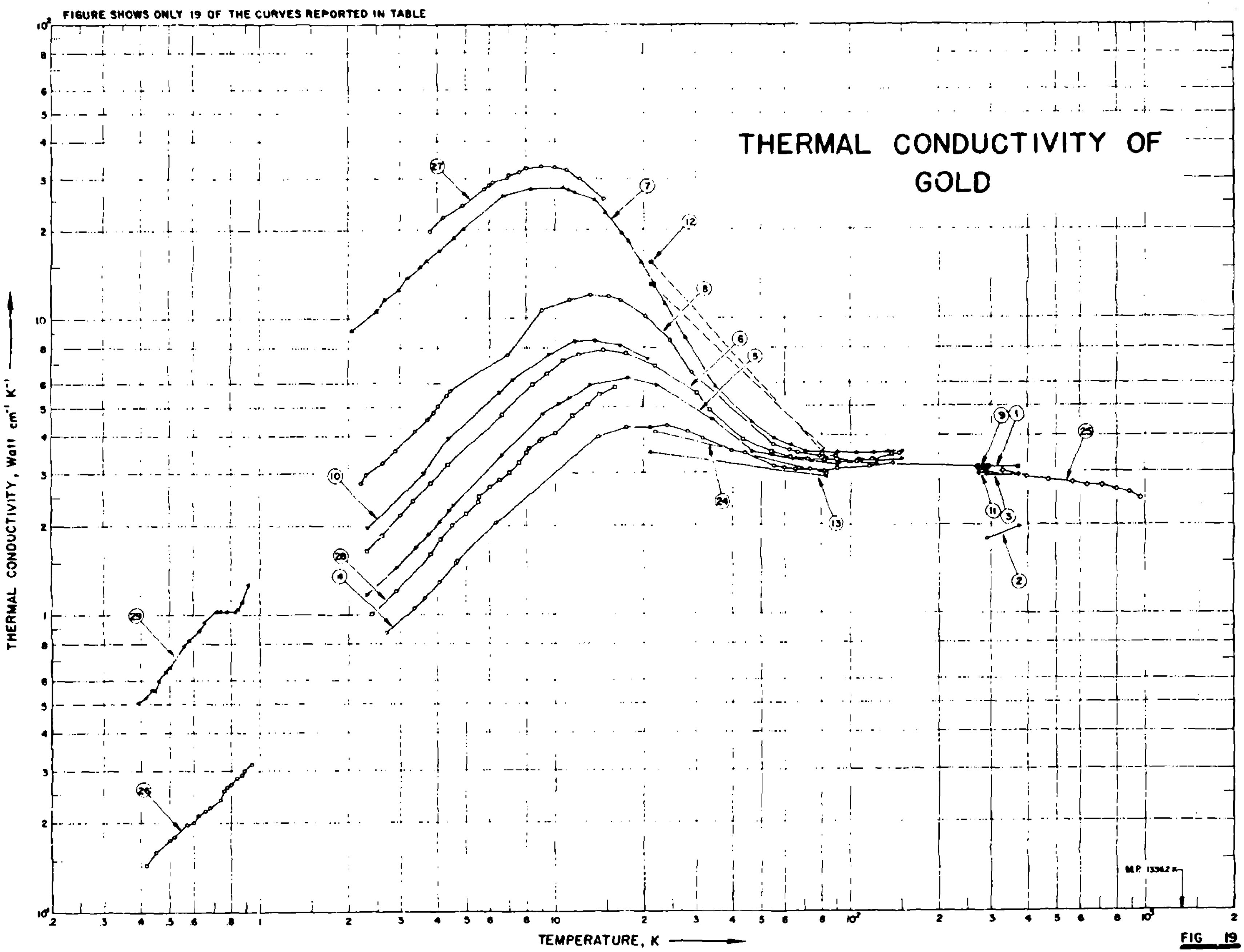


FIGURE SHOWS ONLY 19 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF GOLD
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 1336.2 K

FIG 19

SPECIFICATION TABLE NO. 19 THERMAL CONDUCTIVITY OF GOLD

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 19]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	95	E	1915	22-374			99.999 pure; electrical conductivity 48.4 and 45.1 x 10^4 $ohm^{-1}cm^{-1}$ at 273.1 and 291 K, respectively.
2	77	E	1900	291,373		Au I	99.8 pure; 0.1 Fe, 0.1 Cu.
3	77	E	1900	291,373		Au II	High purity.
4	146	L	1953	2.7-141	1	Au 1	99.9 pure; major impurity Ag, trace Pt, faint traces of Fe, Cu, and Sn; specimen 2 mm in dia obtained from Garrett, Davidson and Matthey of Sydney.
5	146	L	1953	2.3-150	1	Au 2	The above specimen annealed at 700 C in vacuo and slowly cooled.
6	146	L	1953	2.3-148	1	Au 3	99.999^+ pure; spectral analysis showed lines of Ag, and Cu and faint lines of Cd, Fe, Mg, and Na, and very faint lines of Ca and Zn; specimen 1.5 mm dia rod; obtained from Garrett, Davidson and Matthey of Sydney.
7	146	L	1953	2.1-151	1	Au 4	The above specimen annealed at 700 C in vacuo for about 3 hrs and slowly cooled to 200 C in 6 hrs.
8	146	L	1953	2.2-90	1	Au 5	The above annealed specimen cold drawn to 1.3 mm dia.
9	78	E	1931	273-292			99.99 pure; specimen 0.07960 cm in dia and 20.12 cm long.
10	97	L	1952	2.3-21	2-3	Au 1	99.999 pure; polycrystalline wire; *obtained from* Johnson Matthey (JM 1916a).
11	8	L	1914	273-373			Specimen 0.1014 cm in dia; specific gravity 19.49.
12	57	L	1927	21,83		Au 12	High purity; single crystal; unstrained; electrical resistivity reported as 0.0142, 0.488 and 2.04 μohm cm at -252, -190, and 0 C, respectively.
13	57	L	1927	21,83		Au II	Commercially pure; cold-worked and annealed; electrical resistivity reported as 0.1174, 0.599 and 2.16 μohm cm at -252, -190, and 0 C, respectively.
14	172	E	1927	297.2		1a	Specimen 4 mm in dia and 20 cm long; made from forged material and machined to shape; electrical resistivity 2.44 μohm cm at 24 C.
15	172	E	1927	297.2		1b	The above specimen measured after being annealed at 600 C for 1 hr.
16	487	L	1894	326.2			Specimen 2.0 mm dia.
17	246	T	1919	273,373			Rolled and drawn; heated 0.5 hr close to melting point.
18	430	T	1924	273.2			Pure; rolled and drawn to a wire, specimen 3 cm long and 1 mm^2 cross-section, and then heated close to melting point.
19	451		1930	291.2			Pure; tempered at 800 C, quenched, rolled, and drawn.
20	399	L	1925	290,373			Pure.
21	241		1911	298.2			Pure.

SPECIFICATION TABLE NO. 19 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
22	57	L	1927	21, 83		Au 14	High purity; single crystal; unstrained; electrical resistivity reported as 0.0160, 0.490, and 2.04 μohm cm at -252, -190, and 0 C, respectively.
23	57	L	1927	21, 83		Au 13	Originally single crystal, hammered to 2 mm dia; annealed 5.5 hrs at 380 C; electrical resistivity reported as 0.0147, 0.489, and 2.04 μohm cm at -250, -190, and 0 C, respectively.
24	57	L	1927	21, 83		Au IIa	Commercially pure; remelted and hammered to 2 mm dia; annealed; tempered 3 hrs at 390 C; electrical resistivity reported as 0.0941, 0.575, and 2.14 μohm cm at -250, -190, and 0 C, respectively.
25	617		1957	321-964			99.99 pure, polycrystal.
26	683	L	1963	0.418-0.94			99.97 pure, polycrystalline wire.
27	768	L	1964	3.8-15		Oxidized	40 μ thick foils rolled from spec-pure Johnson-Matthey material; annealed at 1223 K for 24 hrs in air, electrical resistance ratio $(R_{273}-R_{4.2})/(R_{4.2})$ 610; electrical resistivity reported as 25.369, 25.379, 25.390, 25.408, 25.442, 25.496, and 25.529 μohm cm at 2.29, 2.79, 3.20, 3.61, 4.11, 4.68, and 4.90 K, respectively; L_0 (2.46 ± 0.02) x 10^{-8} watt ohm K^{-2}.
28	768	L	1964	2.4-16		Vacuum annealed	40 μ thick foils rolled from spec-pure Johnson-Matthey material, annealed at 1223 K for 24 hrs in vacuum (pressure 10^{-5} mm Hg); electrical resistance ratio $(R_{273}-R_{4.2})/(R_{4.2})$ 32.2; electrical resistivity reported as 467.9, 463.8, 461.2, 458.7, 456.9, 455.0, 453.3, 451.9, 450.7, 449.8, 449.0, 448.0, and 448.2 μohm cm at 2.32, 2.79, 3.20, 3.62, 4.0, 4.40, 4.90, 5.38, 5.88, 6.33, 6.80, 7.45, 8.03, and 8.68 K, respectively.
29	736	L	1965	0.39-0.92			Very pure (higher purity than the specimen used by Davey and Mendelssohn 1963); polycrystalline.
30	1005	E	1927	273.2			99.9 pure; specimen 0.125 in. in dia and 10 cm long; obtained from Baker and Co.; electrical resistivity 2.214 μohm cm at 0 C.

DATA TABLE NO. 19 THERMAL CONDUCTIVITY OF GOLD

(Impurity < 0.20% each, total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
21.5	13.062
91.5	3.234
273.1	3.110
291.2	3.110
294.6	3.110
373.7	3.110
CURVE 2	
291.2	1.790
373.2	1.970
CURVE 3	
291.2	2.930
373.2	2.940
CURVE 4	
2.70	0.872
3.35	1.053
3.65	1.143
4.09	1.293
4.60	1.490
4.66	1.528
6.32	2.050
14.00	3.975
17.45	4.292
21.05	4.292
24.05	4.367
28.12	4.157
31.60	3.945
40.00	3.555
44.50	3.494
55.65	3.163
60.15	3.102
65.85	3.087
73.80	3.072
82.10	3.042
90.80	3.087
117.30	3.123
140.80	3.223
CURVE 5	
2.32	1.173
2.89	1.450
3.38	1.692
3.72	1.865
4.06	2.060
4.38	2.255
4.53	2.353
6.62	3.450
9.02	4.747
10.38	5.120
11.28	5.330
13.23	5.905
17.75	6.265
22.25	5.934
34.00	4.548
46.90	3.525
54.90	3.435
64.35	3.313
74.30	3.253
90.70	3.193
108.50	3.313
124.40	3.283
150.40	3.343
CURVE 6	
2.32	1.654
2.60	1.857
2.98	2.180
3.32	2.445
3.79	2.782
4.36	3.203
6.62	4.760
8.42	5.935
9.47	6.490
10.68	7.230
12.05	7.620
14.60	7.860
17.45	7.680
21.80	6.930
30.40	5.540
33.70	4.880
CURVE 6 (cont.)	
43.30	3.885
54.45	3.525
63.15	3.375
72.50	3.315
82.90	3.315
90.80	3.315
106.80	3.250
120.30	3.300
140.20	3.435
148.30	3.465
CURVE 7	
2.05	9.120
2.50	10.640
2.66	11.565
2.96	12.460
3.19	13.830
3.50	15.000
3.65	15.805
4.03	17.060
4.55	18.850
4.95	20.060
6.70	26.030
8.35	27.750
10.70	28.000
11.25	27.600
11.80	26.950
13.70	25.300
14.90	22.950
17.00	19.400
17.85	18.400
19.60	15.750
21.80	13.150
23.80	11.250
27.80	8.625
35.10	5.810
46.20	4.460
55.20	3.915
63.20	3.705
71.30	3.510
81.20	3.490
CURVE 7 (cont.)	
90.80	3.495
106.00	3.480
120.30	3.480
135.00	3.510
150.70	3.540
CURVE 8	
2.20	2.775
2.29	2.970
2.62	3.250
2.89	3.565
3.[illegible]	4.105
3.70	4.555
3.90	4.810
4.05	5.025
4.32	5.450
4.12	5.670
6.92	7.590
9.63	10.580
11.28	11.520
13.25	11.960
15.35	11.837
16.85	11.500
20.30	10.150
24.70	8.495
29.20	6.535
55.60	3.735
62.60	3.555
67.00	3.495
79.40	3.390
89.90	3.385
CURVE 9	
273.20	3.061
278.48	3.067
279.64	3.054
287.06	3.059
291.60	3.067
CURVE 10	
2.31	1.966
3.59	2.991
4.36	3.932
6.50	5.598
7.26	6.197
9.57	7.610
11.71	8.462
13.76	8.462
16.58	8.120
20.60	7.350
CURVE 11	
273.2	2.950
290.2	2.950
373.2	2.933
CURVE 12	
21.2	15.700
83.2	3.320
CURVE 13	
21.2	3.530
83.2	2.900
CURVE 14	
297.2	2.983
CURVE 15	
297.2	2.983
CURVE 16	
326.2	3.102
CURVE 17	
273.2	2.94
373.2	2.95
CURVE 18*	
27[illegible]	2.93
CURVE 19	
291.2	3.09
CURVE 20	
290.2	2.950
373.2	2.933
CURVE 21	
298.2	3.18
CURVE 22	
21.2	15.4
83.2	3.37
CURVE 23	
21.2	15.5
83.2	3.32
CURVE 24	
21.2	4.16
83.2	2.96
CURVE 25	
330.7	3.03
396.2	2.88
471.5	2.82
569.5	2.78
636.5	2.71
716.5	2.70
797.8	2.62
888.8	2.58
963.8	2.46
CURVE 26	
0.418	0.144
0.450	0.160
0.505	0.176
0.524	0.180
0.575	0.197
0.600	0.200
0.625	0.21[illegible]
0.656	0.220
0.680	0.225
0.740	0.240
0.760	0.257
0.780	0.264
0.800	0.270
0.840	0.283
0.870	0.291
0.890	0.300
0.940	0.316
CURVE 27	
3.8	19.75
4.2	21.9
4.9	24.0
5.8	27.5
6.04	28.5
6.2	28.9
6.9	30.1
6.95	30.2*
7.0	30.8
7.6	31.6
8.9	32.3
8.02	32.6
9.0	33.0
10.0	32.7
11.0	32.0
12.2	30.0
14.7	25.6

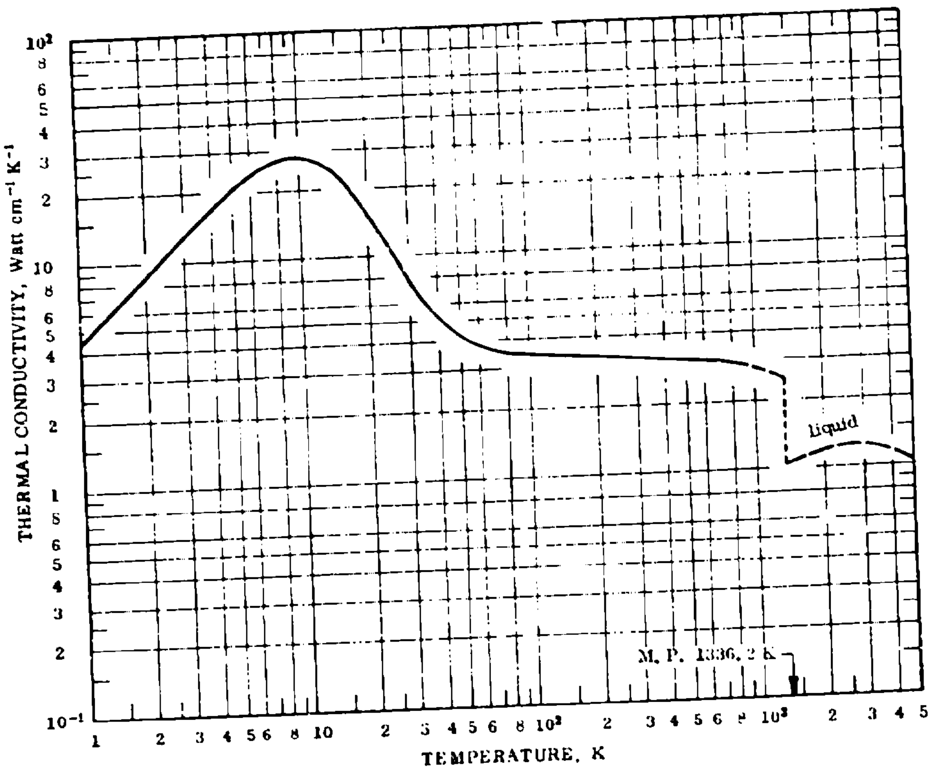
* Not shown on plot

DATA TABLE NO. 19 (continued)

T	k
CURVE 28	
2.4	1.0
2.9	1.2
3.8	1.6
4.1	1.8
4.5	2.0
5.0	2.2
5.5	2.4
5.55	2.5
6.0	2.7
6.5	2.85
7.0	3.0
7.6	3.25
8.05	3.5
8.2	3.6
8.9	3.84
9.0	3.9
10.0	4.1
11.5	4.7
13.0	5.1
14.25	5.5
16.0	5.8
CURVE 29	
0.393	0.505
0.418	0.530
0.44	0.560
0.445	0.555
0.46	0.600
0.488	0.645
0.503	0.668
0.56	0.790
0.585	0.828
0.63	0.890
0.655	0.948
0.715	1.03
0.735	1.03
0.775	1.03
0.83	1.03
0.845	1.05
0.87	1.11
0.92	1.27
CURVE 30*	
273.2	3.01

*Not shown on plot

FIGURE AND TABLE NO. 19R RECOMMENDED THERMAL CONDUCTIVITY OF GOLD



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	4.44	257	-457.9
2	8.85	511	-456.1
3	13.1	757	-454.3
4	17.1	988	-452.5
5	20.7	1200	-450.7
6	23.7	1370	-448.9
7	26.0	1500	-447.1
8	27.5	1590	-445.3
9	28.2	1630	-443.5
10	28.2	1630	-441.7
11	27.7	1600	-439.9
12	26.7	1540	-438.1
13	25.5	1470	-436.3
14	24.1	1390	-434.5
15	22.6	1310	-432.7
16	20.9	1210	-430.9
18	17.7	1020	-427.3
20	15.0	867	-423.7
25	10.2	589	-414.7
30	7.6	439	-405.7
35	6.1	352	-396.7
40	5.2	300	-387.7
45	4.6	266	-378.7
50	4.2	243	-369.7
60	3.8	220	-351.7
70	3.58	207	-333.7
80	3.52	203	-315.7
90	3.48	201	-297.7
100	3.45	199	-279.7
150	3.35	194	-189.7
200	3.27	189	- 99.7
250	3.20	185	- 9.7
273.2	3.18	184	32.0
300	3.15	182	80.3
350	3.13	181	170.3
400	3.12	180	260.3
500	3.09	179	440.3
600	3.04	176	620.3
700	2.98	172	800.3
800	2.92	169	980.3
900	2.85	165	1160

T_1	k_1	k_2	T_2
1000	(2.78)‡	(161)	1340
1100	(2.71)	(157)	1520
1200	(2.62)	(151)	1700
1300	(2.51)	(145)	1880
1336.2	(2.47)	(143)	1945
In Liquid State			
1336.2	(1.05)	(60.7)	1945
1400	(1.06)	(61.2)	2060
1500	(1.09)	(63.0)	2240
1600	(1.12)	(64.7)	2420
1700	(1.14)	(65.9)	2600
1800	(1.16)	(67.0)	2780
1900	(1.18)	(68.2)	2960
2000	(1.20)	(69.3)	3140
2200	(1.22)	(70.5)	3500
2400	(1.24)	(71.6)	3860
2600	(1.25)	(72.2)	4220
2800	(1.25)	(72.2)	4580
3000	(1.25)	(72.2)	4940
3200	(1.24)	(71.6)	5300
3400	(1.23)	(71.1)	5660
3600	(1.21)	(69.9)	6020
3800	(1.19)	(68.8)	6380
4000	(1.17)	(67.6)	6740
4500	(1.11)	(64.1)	7640
5000	(1.02)	(58.9)	8540
5500	(0.933)	(53.9)	9440
6000	(0.839)	(48.5)	10340
7000	(0.620)	(35.8)	12140
8000	(0.384)	(22.2)	13940
9000	(0.131)	(7.57)	15740
9500	(~0)	(~0)	16640

REMARKS

The recommended values are for well-annealed 99.999+% pure gold with residual electrical resistivity $\rho_0 = 0.00530\ \mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 100 K). The values below 1.5 T_m are calculated to fit the experimental data by using $n = 2.00$, $a = 0.46$, $m = 2.46$, $\alpha'' = 4.60 \times 10^{-5}$, and $\beta = 0.225$. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature, and 3 to 6% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1}K^{-1}, T_2 in F, and k_2 in Btu hr^{-1}ft^{-1}F^{-1}.

‡ Values in parentheses are extrapolated or estimated.

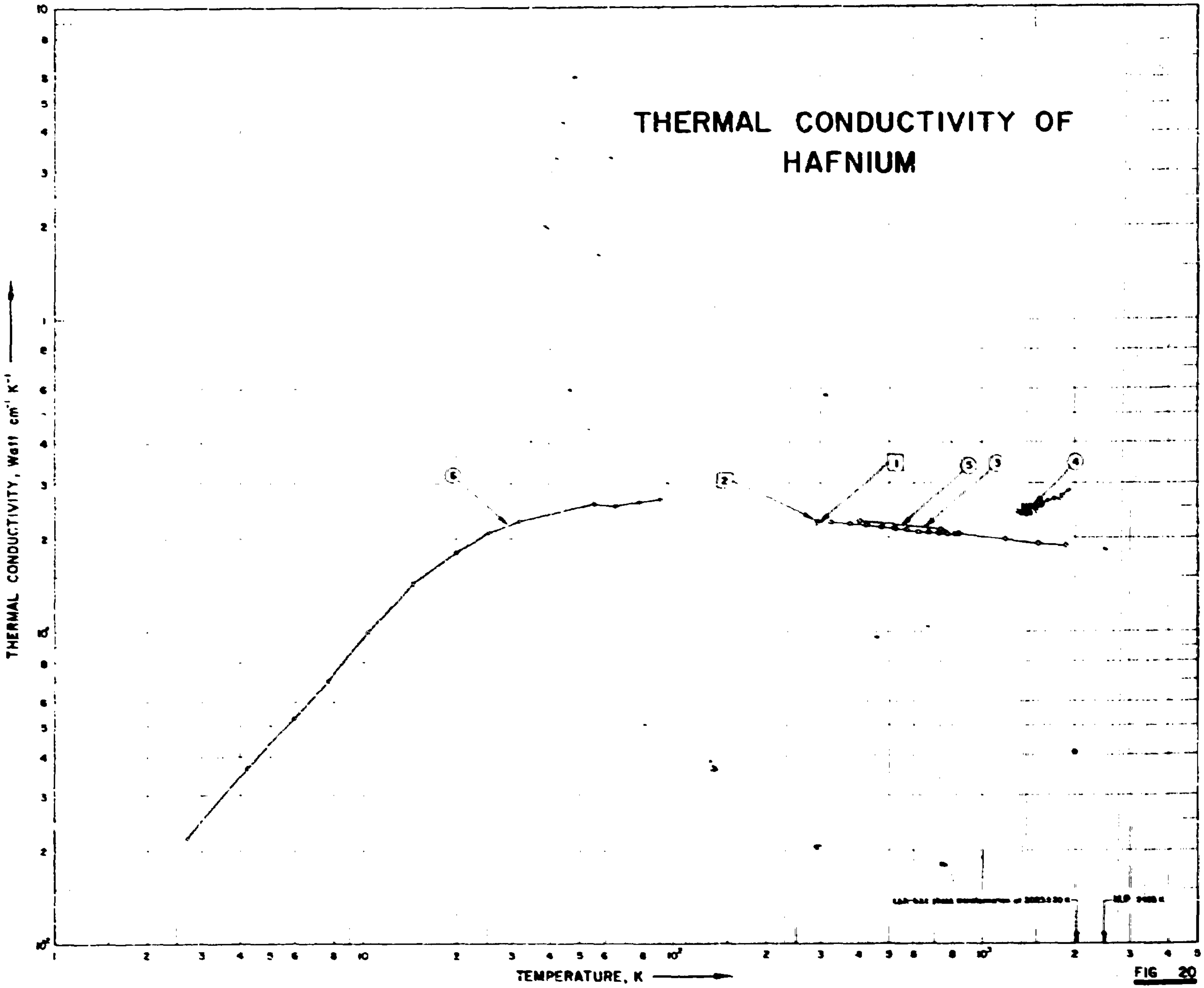

THERMAL CONDUCTIVITY OF
HAFNIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
4
5
6

FIG 20

SPECIFICATION TABLE NO. 20 THERMAL CONDUCTIVITY OF HAFNIUM

[For Data Reported in Figure and Table No. 20]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Hf	Zr	Composition (continued), Specifications and Remarks
1	821		1959	293.2					Density 13.36 g cm^{-3}; electrical resistivity 30 μohm cm at 20 C; data probably not original.
2	822		1961	293.2					Hexagonal close packed; density 13.1 g cm^{-3}; electrical resistivity 35.1 μohm cm at ~20 C.
3	614	R	1961	401-1878	± 5.0				99 Hafnium, 1.0 max Zr, 0.1 max Ti and Si each, 0.01 max Fe, V and Zn each, 0.001 max Mn, Ni and Cu each, 0.0001 max Mg.
4	890, 891	T	1966	1301-1908		Iodide Hf			12 mm dia x 65 mm long; density 13.06 g cm^{-3}; measured in a vacuum of 5 x 10^{-5} mm Hg.
5	336	C	1953	323-823			~ 97.96	2.0	0.008 Pb, 0.007 Al, 0.006 W, 0.005 Fe, 0.004 Cu, < 0.003 Zn, 0.002 each of Si, Ti and Mo, trace Sn, U, Co, Ni, Mg, Cr and Mn; specimen 2 cm in dia and 15 cm long; supplied by Westinghouse Atomic Power Division; electrical resistivity 34.1, 40.6, 47.1, 53.6, 60.1 and 66.6 μohm cm at 0, 50, 100, 150, 200 and 250 C, respectively; measured in vacuum of ~ 1 x 10^{-5} mm Hg; Armco iron used as comparative material.
6	151	L	1957	2 7-9i		HF 1	99.5-99	0.5-1.0	Specimen 5 x 1.52 mm and ~ 6 cm long; supplied by Foote Mineral Co.; as received; ρ_0 = 4.23 μohm cm; electrical resistivity ratio ρ(295 K)/ρ_0 = 8.58.

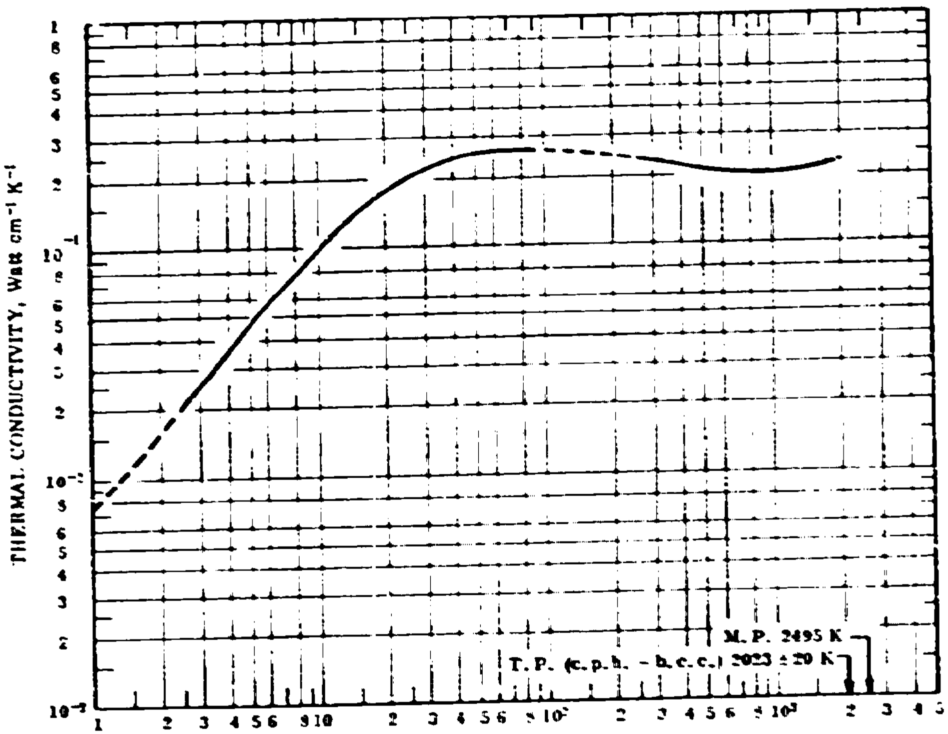
DATA TABLE NO. 20 THERMAL CONDUCTIVITY OF HAFNIUM

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
293.2	0.221
CURVE 2	
293.2	0.224
CURVE 3	
400.9	0.226
737.1	0.212
845.4	0.206
1190.4	0.198
1527.6	0.191
1877.6	0.189
CURVE 4	
1301	0.240
1339	0.236
1352	0.250
1386	0.234
1400	0.249
1432	0.236
1442	0.250
1491	0.239
1501	0.250
1557	0.250
1565	0.254
1538	0.260
1709	0.264
1781	0.265
1807	0.271
1908	0.283
CURVE 5	
323.2	0.223
373.2	0.220
423.2	0.218
473.2	0.215
523.2	0.213
572.2	0.210
623.2	0.208
673.2	0.207

T	k
CURVE 5 (cont.)	
723.2	0.206
773.2	0.205
823.2	0.205
CURVE 6	
2.70	0.0221
4.23	0.0370
5.96	0.0532
7.70	0.0700
10.40	0.100
14.50	0.142
20.00	0.180
25.60	0.208
31.90	0.226
55.80	0.255
65.00	0.251
77.90	0.257
90.80	0.262

FIGURE AND TABLE NO. 20R RECOMMENDED THERMAL CONDUCTIVITY OF HAFNIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.217	12.5	440.3
1	(0.00764)‡	(0.441)	-457.9	600	0.213	12.3	620.3
2	(0.0163)	(0.942)	-456.1	700	0.210	12.1	800.3
3	0.0255	1.47	-454.3	800	0.208	12.0	980.3
4	0.0349	2.02	-452.5	900	0.207	12.0	1160
5	0.0445	2.57	-450.7	1000	0.207	12.0	1340
6	0.0544	3.14	-448.9	1100	0.208	12.0	1520
7	0.0645	3.73	-447.1	1200	0.209	12.1	1700
8	0.0746	4.31	-445.3	1300	0.210	12.1	1880
9	0.0848	4.90	-443.5	1400	0.211	12.2	2060
10	0.0952	5.50	-441.7	1500	0.213	12.3	2240
11	0.106	6.12	-439.9	1600	0.215	12.4	2420
12	0.116	6.70	-438.1	1700	0.218	12.6	2600
13	0.126	7.28	-436.3	1800	0.220	12.7	2780
14	0.135	7.80	-434.5	1900	0.223	12.9	2960
15	0.144	8.32	-432.7	2000	(0.226)	(13.1)	3140
16	0.152	8.78	-430.9				
18	0.167	9.65	-427.3				
20	0.180	10.4	-423.7				
25	0.205	11.8	-414.7				
30	0.221	12.8	-405.7				
35	0.233	13.5	-396.7				
40	0.241	13.9	-387.7				
45	0.247	14.3	-378.7				
50	0.251	14.5	-369.7				
60	0.256	14.8	-351.7				
70	0.259	15.0	-333.7				
80	0.260	15.0	-315.7				
90	0.260	15.0	-297.7				
100	(0.260)	(15.0)	-279.7				
150	(0.251)	(14.5)	-189.7				
200	(0.244)	(14.1)	-99.7				
250	(0.236)	(13.6)	-9.7				
273.2	(0.233)	(13.5)	32.0				
300	0.230	13.3	80.3				
350	0.226	13.1	170.3				
400	0.223	12.9	260.3				

REMARKS

The recommended values are for well-annealed 99% pure hafnium with residual electrical resistivity ρ_0 = 4.23 $\mu\Omega$ cm (characterization by ρ_0 becomes important below room temperature). The values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or interpolated.

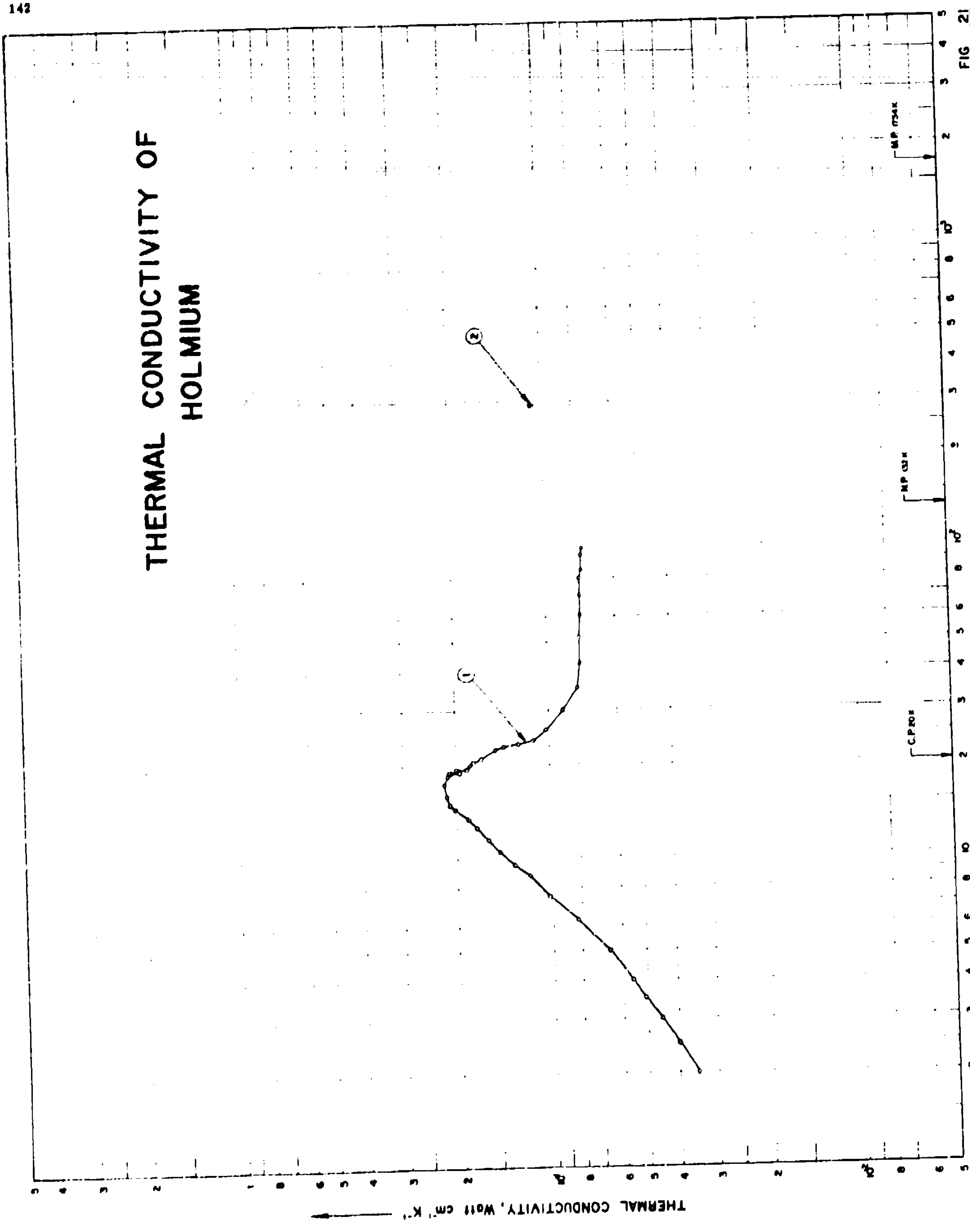

THERMAL CONDUCTIVITY OF HOLMIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
C.P. 20 K
N.P. 132 K
M.P. 1734 K
1
2

FIG 21

SPECIFICATION TABLE NO. 21 THERMAL CONDUCTIVITY OF HOLMIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 21]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	808, 322	L	1965	2.0-100			99.9 pure; polycrystalline; dimensions 3 x 0.2 x 0.025 cm; annealed at 700 C for 3 hrs in vacuum of 10^{-6} mm Hg; electrical resistivity 7.32 μohm cm at 4.2 K; electrical resistivity ratio $\rho(293K)/\rho(4.2K)$ = 10.9; ferromagnetic below 20 K, antiferromagnetic between 20 and 133 K.
2	777	C	1965	291	3		High purity; polycrystalline; 0.25 in. dia, 0.25 in. long; supplied by Johnson Matthey and Co. Ltd.; electrical resistivity 108 μohm cm at 18 C; measurements made using 2 different thermal comparators; Monel metal used as comparative material.

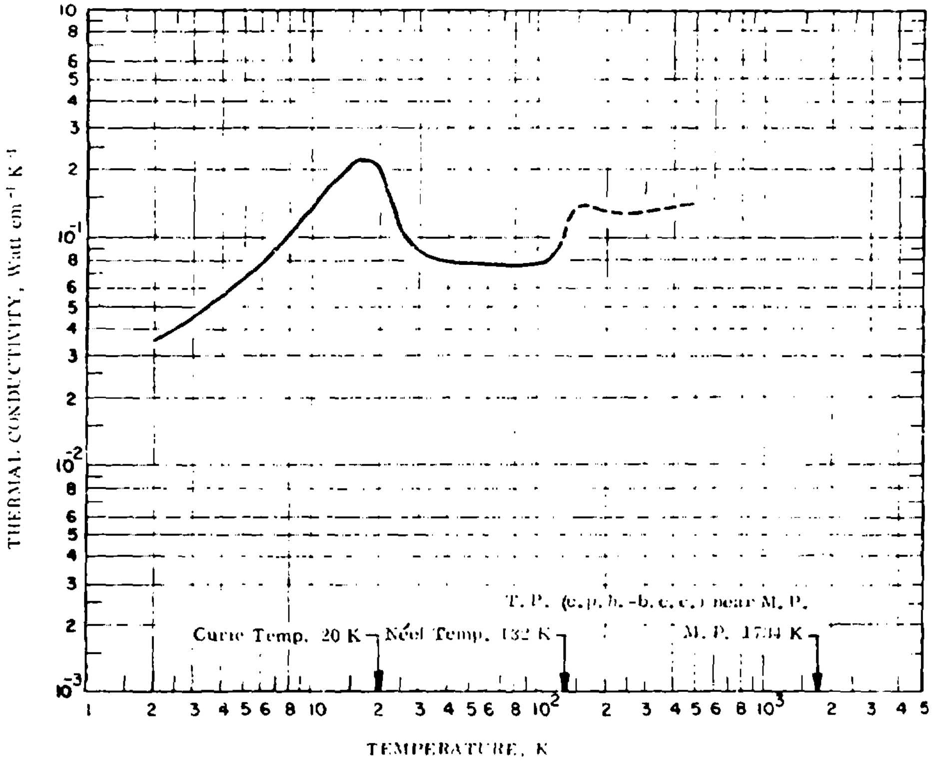
DATA TABLE NO. 21 THERMAL CONDUCTIVITY OF HOLMIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		CURVE 2	
2.0	0.035	291.2	0.105
2.5	0.040	291.2	0.107
3.0	0.045		
3.5	0.051		
4.0	0.056		
5.0	0.066		
6.3	0.083		
7.5	0.103		
8.8	0.117		
9.5	0.132		
10.5	0.147		
11.5	0.160		
12.5	0.175		
13.5	0.185		
14.5	0.202		
15.0	0.210		
16.0	0.215		
17.5	0.217		
18.5	0.213		
19.0	0.211		
19.0	0.207		
19.5	0.200		
19.0	0.195		
19.5	0.186		
20.0	0.182		
20.5	0.177		
21.0	0.167		
22.5	0.150		
23.0	0.140		
23.5	0.125		
24.0	0.112		
26.0	0.102		
30.0	0.090		
35.5	0.080		
42.5	0.078		
51.5	0.078		
61.0	0.077		
70.5	0.077		
80.0	0.077		
85.0	0.076		
95.0	0.076		
100.0	0.075		

FIGURE AND TABLE NO. 21R RECOMMENDED THERMAL CONDUCTIVITY OF HOLMIUM



REMARKS

The recommended values are for well-annealed 99.9% pure holmium with residual electrical resistivity ρ_0 = 7.32 μΩ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 10 to 15% of the true values.

RECOMMENDED VALUES[ξ]
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
2	0.0350	2.02	-456.1
3	0.0454	2.62	-454.3
4	0.0559	3.23	-452.5
5	0.0669	3.87	-450.7
6	0.0796	4.60	-448.9
7	0.0930	5.37	-447.1
8	0.107	6.18	-445.3
9	0.122	7.05	-443.5
10	0.137	7.92	-441.7
11	0.152	8.78	-439.9
12	0.167	9.65	-438.1
13	0.182	10.5	-436.3
14	0.195	11.3	-434.5
15	0.208	12.0	-432.7
16	0.216	12.5	-430.9
18	0.215	12.4	-427.3
20	0.191	11.0	-423.7
25	0.107	6.18	-414.7
30	0.0896	5.18	-405.7
35	0.0808	4.67	-396.7
40	0.0784	4.53	-387.7
45	0.0780	4.51	-378.7
50	0.0777	4.49	-369.7
60	0.0772	4.46	-351.7
70	0.0767	4.43	-333.7
80	0.0762	4.40	-315.7
90	0.0759	4.39	-297.7
100	0.0762	4.40	-279.7
130	(0.0985)[‡]	(5.69)	-225.7
135	(0.115)	(6.64)	-216.7
150	(0.137)	(7.92)	-189.7
170	(0.135)	(7.80)	-153.7
200	(0.130)	(7.51)	- 99.7
250	(0.129)	(7.45)	- 9.7
273.2	(0.129)	(7.45)	32.0
300	(0.130)	(7.51)	80.3
350	(0.132)	(7.63)	170.3
400	(0.134)	(7.74)	260.3
500	(0.141)	(8.15)	440.3

[ξ] T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}. [‡] Values in parentheses are extrapolated or estimated.

FIGURE SHOWS ONLY 20 OF THE CURVES REPORTED IN TABLE

THERMAL CONDUCTIVITY OF INDIUM

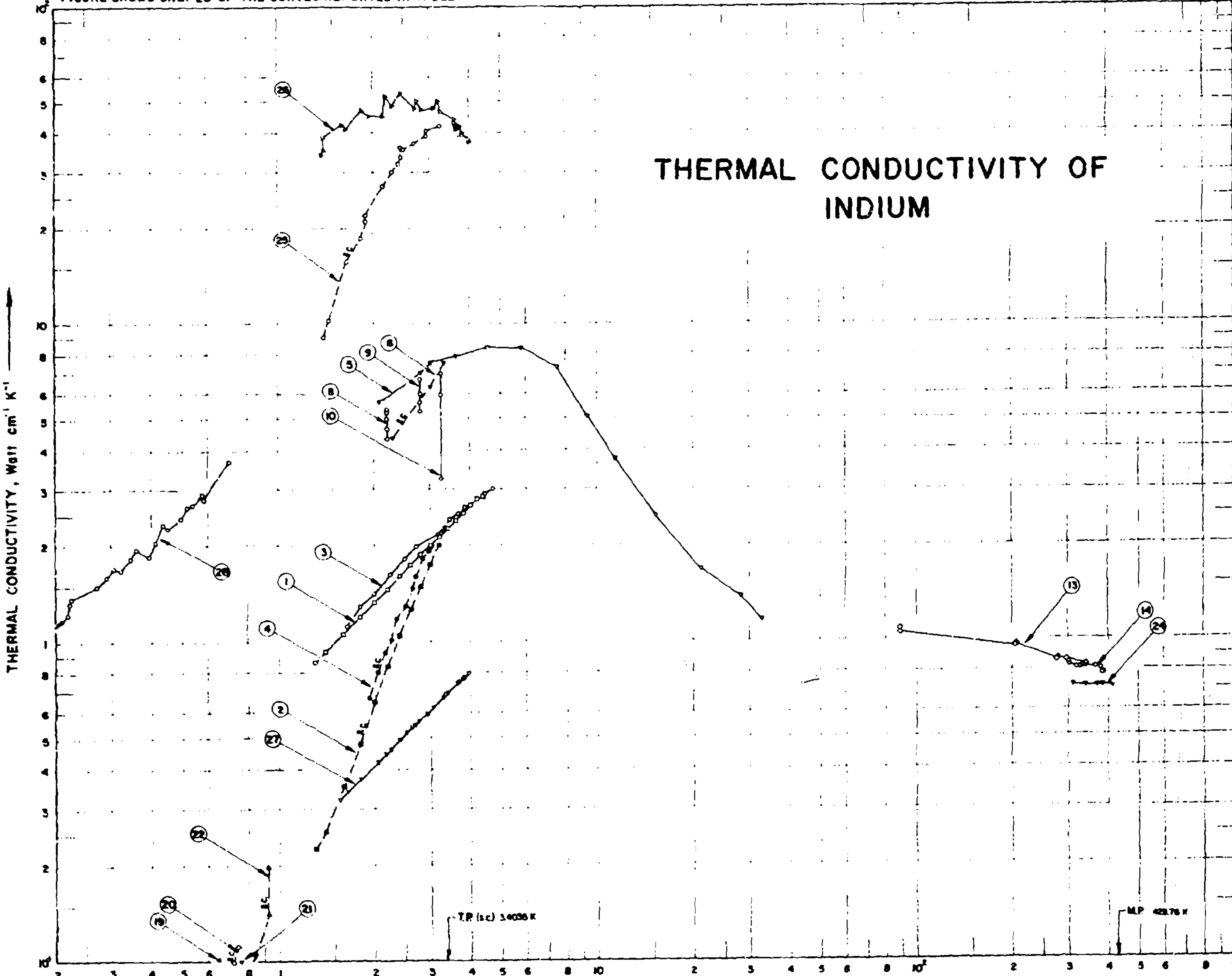


FIG 22

SPECIFICATION TABLE NO. 22 THERMAL CONDUCTIVITY OF INDIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 22]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	132	L	1955	1.3-4.2	±2.5		99.95 pure; single crystal; cylindrical specimen; obtained from Stout, J.W. and Guttman, L.; residual electrical resistivity 0.0371 μohm cm; measured in a vacuum of $< 5 \times 10^{-7}$ mm Hg and in a longitudinal magnetic field of approx 1000 oersteds; in normal state; data from smoothed curve.
2	132	L	1955	1.3-3.2	±2.5		The above specimen measured in superconducting state; data from smoothed curve.
3	76	L	1952	1.7-5			99.9+ pure; single crystal; supplied by Stout, J.W. and Guttman, L.; transition temp 3.40 K; measured in a magnetic field of ~100 gauss; in normal state.
4	76	L	1952	1.9-3.4			The above specimen measured in superconducting state.
5	97	L	1952	2.1-33	2-3	JM 4398; In 1	99.993 pure; polycrystalline; 1-2 mm dia x 5 cm long; supplied by Johnson Matthey; in normal state.
6	97	L	1952	2.3-3.3		JM 4398; In 1	The above specimen measured in superconducting state.
7	794, 400	L	1953	0.46-0.87		JM 4396; In 2	99.993 pure; single crystal; in superconducting state; preliminary result.
8	342	L	1953	2.2		JM 4398; In 1	99.993 pure; polycrystalline; 1-2 mm dia x 5 cm long; supplied by Johnson Matthey; annealed in vacuo; measured in transverse magnetic fields of strength ranging from 0.34 to 2.87 kilooersteds kOe.
9	342	L	1953	2.8		JM 4398; In 1	The above specimen measured in magnetic fields of strength ranging from 0.34 to 2.87 kOe.
10	342	L	1953	3.25		JM 4398; In 1	The above specimen measured in H ranging from 1.10 to 3.94 kOe.
11	290, 285	L	1952	2.13		JM 3249; In	Pure; single crystal; 2.8 mm dia; spectroscopically standardized indium supplied by Johnson Matthey; cast; somewhat strained in mounting; electrical resistivity ratio $\rho(273\ K)/\rho(4.2\ K) = 5500$; measured in transverse magnetic fields of strength ranging from 0 to 190 gauss.
12	290, 285	L	1952	2.13		JM 3249; In	The above specimen measured in transverse fields of decreasing strength ranging from 184 to 0 gauss.
13	795	L	1962	89-342	~2		Total impurity < 0.03 (probably Sn and Pb); ~0.85 cm dia x 6.5 cm long; supplied by Johnson Matthey; electrical resistivity reported as 1.65, 3.08, 4.60, 6.22, 8.0, 10.0, 12.15, and 13.0 μohm cm at 73, 123, 173, 223, 273, 323, 373, and 393 K, respectively; Lorenz function reported as 2.46, 2.60, 2.62, 2.60, 2.57, 2.59, 2.61, and 2.61×10^{-8} V ohm K^{-2} at the above temps, respectively; density 7.334 g cm^{-3}.
14	795	C	1962	303-390	~2		The above specimen measured in another apparatus; Armco iron used as comparative material.

SPECIFICATION TABLE NO. 22 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
15	454	L	1958	0.26-0.56	2	JM 10281; A0	Spectroscopically pure; single crystal; 4.79 mm dia; indium supplied by Johnson Matthey; cast, crystallized, annealed in air at 120 C and electropolished; residual electrical resistivity 0.00125 μohm cm; in superconducting state.
16	454	L	1958	0.27-0.58	2	JM 10281; A1	The above specimen etched with 25% H_2SO_4 solution; in superconducting state.
17	454	L	1958	0.36-0.59	2	JM 10281; A2	The above specimen etched with 25% H_2SO_4 solution and annealed at 120 C for 9 days; in superconducting state.
18	454	L	1958	0.32-0.65	2	JM 10281; A3	The above specimen electropolished (dia reduced to 1.86 mm); damaged by bending during reduction; in superconducting state.
19	454	L	1958	0.34-0.65	2	JM 10281; A4	The above specimen etched with 25% H_2SO_4 solution; in superconducting state.
20	454	L	1958	0.30-0.74	2	JM "chem pure"; B0	99.9 pure (by difference); single crystal; 3.13 mm dia; supplied by Johnson Matthey; cast, crystallized, electropolished, and annealed in air at 120 C; in superconducting state.
21	454	L	1958	0.30-0.76	2	JM "chem pure"; B1	The above specimen etched with 25% H_2SO_4 solution; in superconducting state.
22	412	L	1955	0.25-0.93		JM 4938	99.993 pure; single crystal; ~1 mm dia x 4 cm long; made from Johnson Matthey metal; in superconducting state.
23	412	L	1955	0.29-0.79		JM 4938	99.993 pure; polycrystal; 1.6 mm dia x 4 cm long; made from Johnson Matthey metal; in superconducting state.
24	796	L	1964	313-417	7-8		99.997 pure.
25	797, 798	L	1960	1.4-3.3			Spectroscopically pure; polycrystalline; ~0.5 mm in dia; extruded; annealed at room temp for several months; electrical resistivity ratio ρ(room temp)/ρ(0 K) estimated to be 11000; in superconducting state.
26	797, 798	L	1960, 1961	1.4-4.0			The above specimen measured in a longitudinal magnetic field; in normal state (data corrected to zero field).
27	799	L	1965	1.6-4.0	2	In 1	Bi as major impurity; specimen ~3 mm dia; In supplied by American Smelting and Refining Co.; cast in vacuum; annealed near melting point for at least 2 wks; residual electrical resistivity 0.122 μohm cm; transition temp 3.39 K; measured in a magnetic field; in normal state.
28	732	L	1965	0.023-0.70			99.999 pure (nominal); 0.5 mm dia x 5 cm long; supplied by Koch-Light Laboratories Ltd. (Colnbrook, England); measured in a longitudinal magnetic field of 350 gauss; in normal state.
29	892, 893	L	1963	312-415	7-8		99.997 pure.

DATA TABLE NO. 22 THERMAL CONDUCTIVITY OF INDIUM

Impurity < 0.20% each; total impurities < 0.50%

Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}

CURVE 1

T	k
1.30	0.860
1.40	0.930
1.60	1.060
1.80	1.200
2.00	1.330
2.20	1.460
2.40	1.600
2.60	1.730
2.80	1.860
3.00	2.000
3.20	2.130
3.40	2.260
3.60	2.400
3.80	2.530
4.00	2.660
4.20	2.790

CURVE 2

T	k
1.30	0.225
1.40	0.255
1.60	0.353
1.80	0.480
2.00	0.650
2.20	0.840
2.40	1.050
2.60	1.270
2.80	1.480
3.00	1.740
3.20	2.060

CURVE 3

T	k
1.65	1.117
1.80	1.297
2.00	1.417
2.25	1.624
2.50	1.812
2.71	1.978
3.18	2.174
3.45	2.409
3.68	2.518

CURVE 3 (cont.)

T	k
3.85	2.632
3.95	2.670
4.14	2.747
4.40	2.834
4.45	2.894
4.71	3.000

CURVE 4

T	k
1.93	0.670
2.05	0.804
2.16	0.926
2.27	1.014
2.35	1.188
2.51	1.297
2.64	1.471
2.70	1.597
2.84	1.809
2.98	1.907
3.17	2.151
3.35	2.289

CURVE 5

T	k
2.08	5.667
2.81	7.000
3.02	7.500
3.65	7.875
4.58	8.396
5.83	8.333
7.50	7.250
9.37	5.042
11.46	3.750
15.31	2.458
21.15	1.667
28.12	1.375
32.81	1.167

CURVE 6

T	k
2.29	4.375
3.02	6.333
3.33	7.500

CURVE 7

T	k
0.455	0.00250
0.465	0.00260
0.480	0.00270
0.485	0.00300
0.502	0.00319
0.515	0.00360
0.517	0.00380
0.595	0.00580
0.62	0.00615
0.665	0.00800
0.700	0.00940
0.800	0.0147
0.845	0.0189
0.871	0.0217

CURVE 8
(T = 2.2K)
(kilooersteds)

H	k
0.34	5.38
0.70	5.24
1.43	5.00
2.17	4.67
2.87	4.35

CURVE 9
(T = 2.8K)

H	k
0.51	6.71
1.43	6.02
2.29	5.65
2.87	5.26

CURVE 10
(T = 3.25K)

H	k
1.10	6.99
2.50	5.99
3.94	3.25

CURVE 11
(T = 2.13K)
(gauss)

H	k
0	18.6
15	18.7
55	18.7
68	18.7
78	18.7
82	18.5
85	18.1
88	18.1
91	17.9
98	17.9
103	17.9
106	17.9
116	18.1
123	18.6
130	19.1
136	19.8
143	20.8
150	23.1
153	25.1
163	26.5
170	26.3
177	26.1
190	26.0

CURVE 12
(T = 2.13K)

H	k
184	26.1
160	26.5
157	26.3
154	25.8
150	24.5
136	20.8
124	18.5
113	18.1
107	17.7
103	17.7
88	17.6
81	18.0
75	18.1
70	18.1

CURVE 12 (cont.)
(T = 2.13K)
(gauss)

H	k
60	18.1
55	18.1
0	18.1

CURVE 13

T	k
89.2	1.08
89.2	1.065
205.2	0.952
236.7	0.963
278.2	0.860
279.7	0.875
298.2	0.855
342.2	0.850

CURVE 14

T	k
303.2	0.840
305.2	0.825
320.2	0.810
327.2	0.810
334.2	0.815
341.2	0.818
342.2	0.815
361.2	0.840
370.2	0.805
382.2	0.800
387.2	0.780
390.2	0.780

CURVE 15

T	k
0.264	0.0050
0.273	0.00548
0.300	0.0056
0.305	0.0062
0.322	0.0061
0.335	0.00715
0.345	0.0076
0.358	0.0092

CURVE 15 (cont.)

T	k
0.450	0.0232
0.453	0.025
0.465	0.027
0.490	0.030
0.503	0.0365
0.520	0.043
0.530	0.0502
0.549	0.060
0.560	0.0795

CURVE 16

T	k
0.270	0.0029
0.275	0.0032
0.284	0.00348
0.295	0.00398
0.310	0.0048
0.315	0.00522
0.330	0.00585
0.342	0.0068
0.350	0.00715
0.377	0.0102
0.382	0.0113
0.450	0.020
0.470	0.0222
0.490	0.0260
0.524	0.0382
0.530	0.0405
0.570	0.0526
0.575	0.0638

CURVE 17

T	k
0.360	0.0075
0.360	0.0082
0.40	0.0126
0.41	0.0138
0.415	0.0145
0.428	0.0159
0.428	0.0187
0.59	0.0698

CURVE 18*

T	k
0.324	0.00232
0.335	0.0026
0.353	0.00345
0.360	0.0037
0.370	0.0042
0.398	0.00505
0.420	0.0069
0.450	0.00875
0.455	0.0092
0.505	0.0152
0.550	0.0273
0.555	0.0318
0.580	0.0440
0.602	0.0510
0.615	0.0613
0.640	0.0805
0.650	0.0910

CURVE 19

T	k
0.340	0.00260
0.350	0.00296
0.355	0.00330
0.370	0.00395
0.380	0.00455
0.385	0.00470
0.415	0.00605
0.470	0.0107
0.495	0.0120
0.520	0.0190
0.535	0.0250
0.555	0.0335
0.622	0.0735
0.650	0.102

CURVE 20

T	k
0.298	0.0030
0.305	0.0032
0.310	0.00365
0.324	0.00418
0.350	0.00537
0.372	0.0070

CURVE 20 (cont.)

T	k
0.402	0.0104
0.420	0.0119
0.45	0.0153
0.46	0.020
0.51	0.0265
0.52	0.0276
0.535	0.0312
0.595	0.0450
0.60	0.0480
0.61	0.0520
0.68	0.0760
0.72	0.0998
0.74	0.112

CURVE 21

T	k
0.302	0.00258
0.326	0.00330
0.330	0.00374
0.348	0.00415
0.350	0.0045
0.360	0.00504
0.370	0.0056
0.385	0.0066
0.398	0.0072
0.420	0.00915
0.450	0.0127
0.460	0.0150
0.490	0.0177
0.505	0.0211
0.513	0.0220
0.526	0.0260
0.555	0.0325
0.562	0.0340
0.590	0.0370
0.618	0.0450
0.623	0.0475
0.648	0.0550
0.655	0.0630
0.705	0.0805
0.745	0.0898
0.760	0.100

* Not shown on plot

DATA TABLE NO. 22 (continued)

CURVE 22

T	k
0.248	0.00355
0.255	0.00375
0.280	0.00425
0.295	0.00470
0.310	0.00450
0.315	0.00525
0.315	0.00600
0.350	0.00600
0.400	0.00860
0.410	0.00840
0.450	0.00910
0.450	0.00980
0.475	0.0124
0.490	0.0125
0.510	0.0120
0.530	0.0115
0.595	0.0178
0.700	0.0230
0.705	0.0320
0.748	0.0345
0.860	0.0740
0.810	0.0930
0.930	0.142
0.930	0.198

CURVE 23

T	k
0.285	0.0021
0.301	0.0026
0.390	0.0049
0.402	0.0059
0.475	0.0109
0.550	0.019
0.648	0.022
0.790	0.041

CURVE 24

T	k
313.2	0.715
342.2	0.707
372.2	0.711
388.2	0.714
417.2	0.705

CURVE 25

T	k
1.40	9.0
1.45	10.3
1.65	15.5
1.82	18.5
1.90	21.0
1.90	22.0
2.15	27.0
2.30	30.0
2.40	32.0
2.45	33.5
2.45	36.0
2.50	35.5
2.70	37.0
2.95	39.0
2.95	40.5
3.25	42.0

CURVE 26

T	k
1.38	34.0
1.40	35.0
1.40	38.5
1.60	42.5
1.65	41.0
1.85	47.0
1.95	45.0
2.15	45.0
2.20	52.0
2.30	48.5
2.45	53.0
2.70	47.5
2.75	50.0
2.85	47.0
3.10	47.5
3.20	50.0
3.25	46.5
3.60	44.0
3.60	43.0
3.65	42.0
3.65	41.0
3.75	42.0
3.80	40.0
4.00	38.0
4.00	37.5

CURVE 27

T	k
1.55	0.320
1.65	0.341
1.80	0.372
2.05	0.423
2.17	0.447
2.25	0.463
2.40	0.493
2.53	0.519
2.63	0.540
2.67	0.548
2.75	0.564
2.92	0.596
3.05	0.621
3.30	0.671
3.35	0.681
3.37	0.684
3.40	0.690
3.43	0.696
3.65	0.737
3.70	0.747
3.70	0.746
3.80	0.764
3.80	0.765
3.85	0.774
3.95	0.793

CURVE 28

T	k
0.023	0.17
0.024	0.143
0.028	0.173
0.0285	0.212
0.029	0.205
0.032	0.195
0.0335	0.21
0.034	0.215
0.034	0.23
0.036	0.23
0.039	0.245
0.041	0.26
0.041	0.23
0.043	0.245
0.044	0.285
0.045	0.31

CURVE 28 (cont.)

T	k
0.046	0.315
0.048	0.28
0.0555	0.34
0.060	0.385
0.061	0.36
0.070	0.40
0.072	0.44
0.078	0.405
0.0795	0.425
0.084	0.45
0.085	0.49
0.091	0.56
0.093	0.50
0.099	0.56
0.103	0.54
0.103	0.60
0.119	0.62
0.113	0.61
0.118	0.63
0.118	0.67
0.128	0.70
0.133	0.74
0.140	0.75
0.150	0.81
0.155	0.84
0.155	0.89
0.160	0.91
0.165	0.95
0.180	1.01
0.190	1.08
0.220	1.23
0.225	1.33
0.250	1.38
0.270	1.50
0.290	1.60
0.305	1.70
0.320	1.68
0.345	1.83
0.360	1.95
0.395	1.85
0.415	2.05
0.435	2.31
0.450	2.27
0.495	2.45

CURVE 28 (cont.)

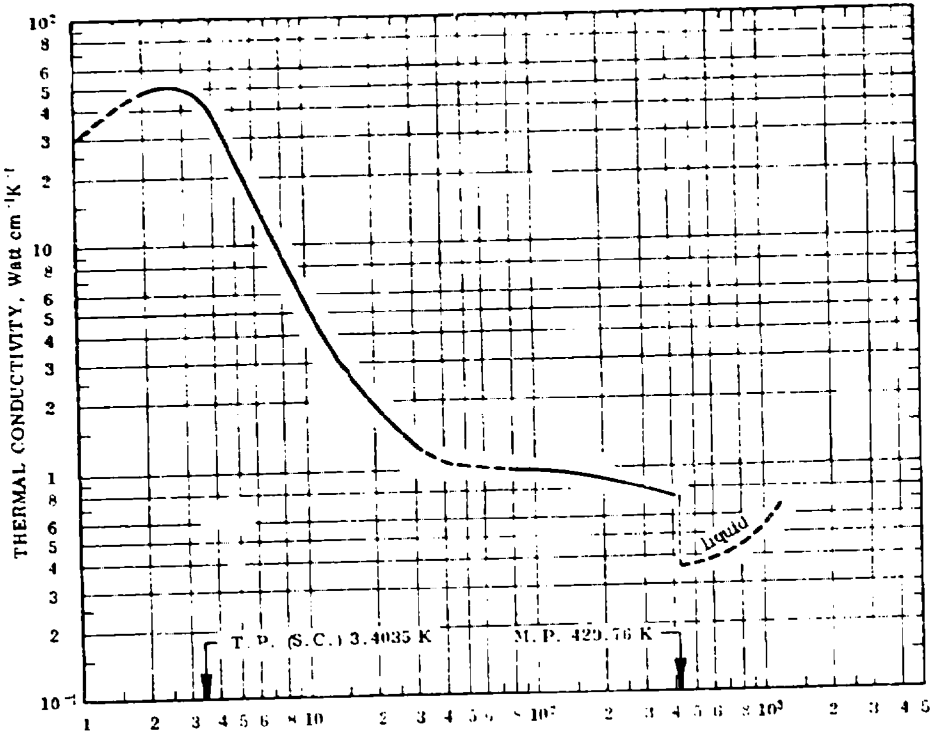
T	k
0.520	2.65
0.540	2.70
0.580	2.90
0.585	2.80
0.70	3.70

CURVE 29*

T	k
312.2	0.720
343.2	0.711
373.2	0.720
388.2	0.724
415.2	0.716

* Not shown on plot

FIGURE AND TABLE NO. 22R RECOMMENDED THERMAL CONDUCTIVITY OF INDIUM



REMARKS

The recommended values are for well-annealed high-purity indium with residual electrical resistivity ρ_0 = 0.000828 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 80 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures.

RECOMMENDED VALUES*

	Polycrystalline			In Liquid State			
T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	429.76	(0.360)	(20.8)	313.90
1	(29.5)‡	(1700)	-457.9	500	(0.372)	(21.5)	440.3
2	47.8	2760	-456.1	600	(0.389)	(22.5)	620.3
3	48.9	2830	-454.3	700	(0.414)	(23.9)	800.3
4	37.3	2160	-452.5	800	(0.444)	(25.7)	980.3
5	24.4	1410	-450.7	900	(0.478)	(27.6)	1160
6	16.4	948	-448.9	1000	(0.524)	(30.3)	1340
7	11.7	676	-447.1	1100	(0.585)	(33.8)	1520
8	8.70	503	-445.3	1200	(0.678)	(39.2)	1700
9	6.85	396	-443.5				
10	5.58	322	-441.7				
11	4.72	273	-439.9				
12	4.09	236	-438.1				
13	3.60	208	-436.3				
14	3.20	185	-434.5				
15	2.88	166	-432.7				
16	2.62	151	-430.9				
18	2.22	128	-427.3				
20	1.94	112	-423.7				
25	1.51	87.2	-414.7				
30	1.28	74.0	-405.7				
35	(1.15)	(66.4)	-396.7				
40	(1.09)	(63.0)	-387.7				
45	(1.06)	(61.2)	-378.7				
50	(1.04)	(60.1)	-369.7				
60	(1.02)	(58.9)	-351.7				
70	(1.00)	(57.8)	-333.7				
80	(0.982)	(57.3)	-315.7				
90	0.983	56.8	-297.7				
100	0.976	56.4	-279.7				
150	0.939	54.3	-189.7				
200	0.897	51.8	- 99.7				
250	0.855	49.4	- 9.7				
273.2	0.837	48.4	32.0				
300	0.817	47.2	80.3				
350	0.777	44.9	170.3				
400	0.745	43.0	260.3				
429.76	(0.729)	(42.1)	313.90				

*T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}. ‡Values in parentheses are extrapolated, interpolated, or estimated.

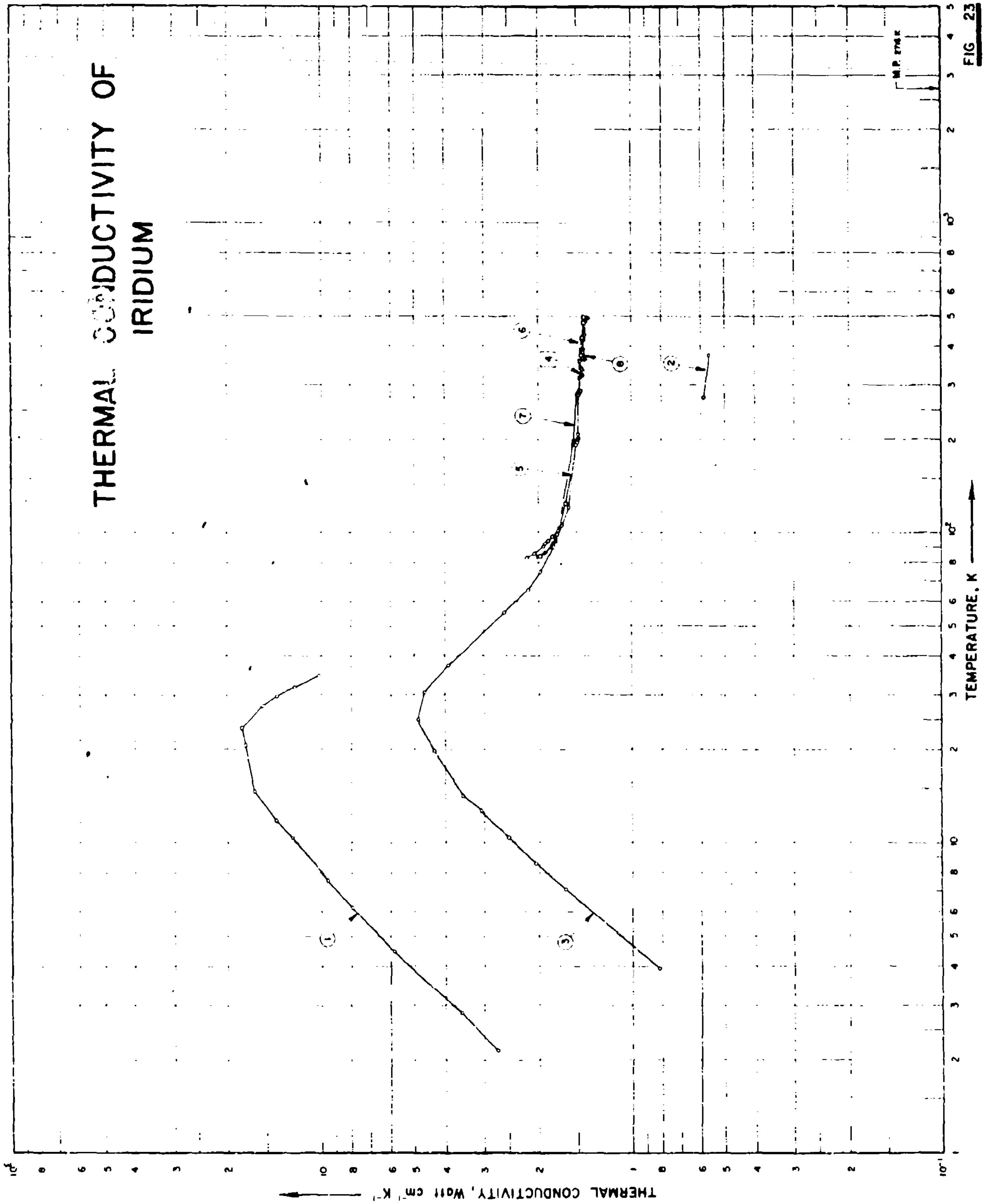

THERMAL CONDUCTIVITY OF
IRIDIUM
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
1
2
3
4
5
6
7
8

FIG 23

SPECIFICATION TABLE NO. 23 THERMAL CONDUCTIVITY OF IRIDIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 23]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	97	L	1952	2.2-35	2.0-3.0	JM 3441; Ir 1	99.995 pure; 1-2 mm dia x 5 cm long; supplied by Johnson Matthey; annealed.
2	8	F	1914	290, 373			Pure; square cross section 0.103 x 0.103 cm, 10.0 cm long; specific gravity 22.33; electrical resistivity reported as 8.190, 8.480, 10.521, and 10.59 μohm cm at 0, 12.11, 97.20, and 100 C, respectively.
3	149	L	1957	3.9-90		JM 10371; Ir 2	99.98⁺ pure; approx impurities: 0.01 [illegible] 0.002 Pt, and 0.001 Cu; 2 mm dia x 5-7 cm long; supplied by Johnson Matthey; annealed at 1300 C; residual electrical resistivity (ρ_0) = 0.1034 μohm cm; electrical resistivity ratio ρ(295 K)/ρ(0 K) = 49.5; Lorenz function 2.50 x 10^{-8} V^2 K^{-2} at 0 K.
4	411	C	1955	323.2			Impurities estimated: 0.02-0.05 Rh, 0.002-0.005 Ru, and 0.001 Pd; 5 cm long, 0.3182 cm in dia; supplied by Johnson Matthey; annealed at 1313 C; density 22.49 g cm^{-3}.
5	411	L	1955	83-269	<3.1		The above specimen; electrical resistivity reported as 0.79, 0.85, 0.95, 1.00, 1.02, 1.10, 1.20, 1.29, 1.59, 3.05, 3.17, 3.31, 3.43, 4.82, 4.92, and 5.07 μohm cm at -190.5, -187.5, -183.2, -180.8, -179.6, -175.8, -171.2, -166.9, -152.7, -82.2, -77.0, -70.0, -64.1, 4.3, 8.8, and 16.1 C, respectively.
6	665	L, C	1962	83-493			0.02-0.05 Rh, 0.002-0.005 Ru, and 0.001 Pd; 5.0 cm long, 0.318 cm in dia; supplied by Johnson Matthey; heated to 1310 C; density 22.43 g cm^{-3}; electrical resistivity 4.71 μohm cm at 273 K; residual electrical resistivity 0.055 μohm cm; data obtained by using two methods of measurement for low and moderate temp ranges; Armco iron used as comparative material for the moderate temp measurement.
7	249	L	1967	83-386			0.02-0.05 Rh, 0.002-0.005 Ru, and 0.001 Pd; specimen 0.318 cm in dia and 5 cm long; supplied by Johnson Matthey; annealed at 1590 K; density 22.43 g cm^{-3}; electrical resistivity ratio ρ(273 K)/ρ(4.2 K) = 85.7; electrical resistivity reported as 1.16, 3.25, 5.33, 7.39, and 9.42 μohm cm at 100, 200, 300, 400, and 500 K, respectively.
8	249	C	1967	315-492			The above specimen measured in a comparative apparatus using Armco iron as reference material.

DATA TABLE NO. 23 THERMAL CONDUCTIVITY OF IRIDIUM

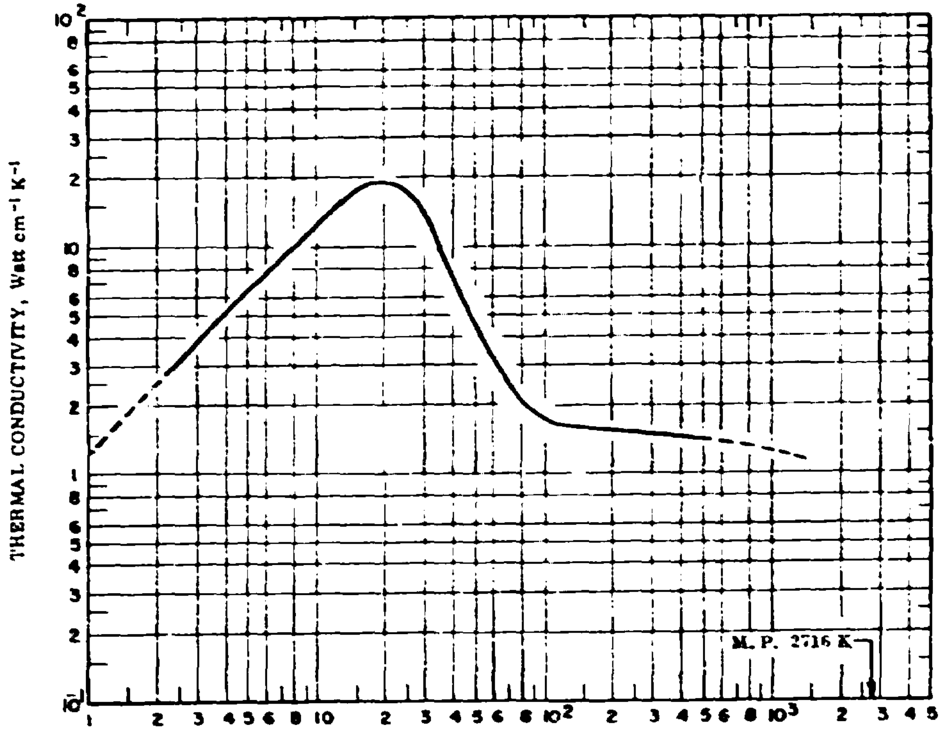
(Impurity <0.20% each; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
2.15	2.710
2.84	3.570
4.47	5.849
6.19	7.914
7.57	9.591
10.49	12.473
11.79	13.978
14.62	16.559
20.65	17.677
23.50	18.150
27.53	15.613
29.76	13.892
31.83	12.129
34.58	10.237
CURVE 2	
290.2	0.590
373.2	0.565
CURVE 3	
3.92	0.821
7.09	1.642
8.58	2.052
10.45	2.500
12.69	3.060
14.18	3.545
19.78	4.328
25.06	4.888
30.60	4.664
37.31	3.918
55.20	2.575
65.30	2.164
74.60	1.978
89.90	1.791
CURVE 4	
323.2	1.45
CURVE 5	
82.7	2.20
85.7	2.07
90.0	1.94
92.4	1.91
93.6	1.87
97.4	1.81
102.0	1.74
106.3	1.66
120.5	1.60
191.0	1.51
196.2	1.50
203.2	1.49
209.1	1.49
277.5	1.48
282.0	1.47
289.3	1.46
CURVE 6	
83.2	1.98
[illegible]	1.75
[illegible]	1.62
[illegible]	1.56*
173.2	1.54*
223.2	1.50
273.2	1.48*
323.2	1.47*
373.2	1.45
423.2	1.44
473.2	1.425
493.2	1.42
CURVE 7	
82.7	2.01
85.2	1.905
90.0	1.905
92.5	1.79
93.5	1.765
98.1	1.79*
CURVE 7 (cont.)	
102.6	1.72
107.1	1.685*
190.9	1.54
196.1	1.535
203.1	1.505*
209.0	1.49*
277.4	1.49
281.9	1.48
289.2	1.475
386.1	1.45
CURVE 8	
315.1	1.45
316.6	1.475*
327.7	1.475*
333.8	1.445
341.4	1.455
356.5	1.465
361.9	1.40
372.3	1.445*
399.3	1.45
408.5	1.43*
414.8	1.42*
416.8	1.425*
418.8	1.425
429.5	1.435*
433.1	1.42
477.2	1.405
492.2	1.385

* Not shown on Plot

FIGURE AND TABLE NO. 23R RECOMMENDED THERMAL CONDUCTIVITY OF IRIDIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	(1.41)	81.5	440.3
1	(1.20)‡	(75.1)	-457.9	600	(1.38)	79.7	620.3
2	(2.60)	(150)	-456.1	700	(1.35)	78.0	800.3
3	3.90	225	-454.3	800	(1.32)	76.3	980.3
4	5.19	300	-452.5	900	(1.29)	74.5	1160
5	6.48	374	-450.7	1000	(1.26)	72.8	1340
6	7.77	449	-448.9	1100	(1.23)	71.1	1520
7	9.04	522	-447.1	1200	(1.20)	69.3	1700
8	10.3	595	-445.3	1300	(1.17)	67.6	1880
9	11.5	664	-443.5	1400	(1.14)	65.9	2060
10	12.7	734	-441.7	1500	(1.11)	64.1	2240
11	13.8	797	-439.9				
12	14.9	861	-438.1				
13	15.9	919	-436.3				
14	16.7	965	-434.5				
15	17.5	1010	-432.7				
16	18.1	1050	-430.9				
18	18.9	1090	-427.3				
20	19.0	1100	-423.7				
25	17.2	994	-414.7				
30	13.7	792	-405.7				
35	10.1	594	-396.7				
40	7.50	433	-387.7				
45	5.89	340	-378.7				
50	4.72	273	-369.7				
60	3.31	191	-351.7				
70	2.54	147	-333.7				
80	2.09	121	-315.7				
90	1.94	106	-297.7				
100	1.72	99.4	-279.7				
150	1.59	91.9	-189.7				
200	1.53	88.4	- 99.7				
250	1.49	86.1	- 9.7				
273.2	1.48	85.5	32.0				
300	1.47	84.9	80.3				
350	1.46	84.4	170.3				
400	1.44	83.2	260.3				

REMARKS

The recommended values are for well-annealed 99.995% pure iridium with residual electrical resistivity ρ_0 = 0.0188 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 150 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 3.00, α' = 0.0175 x 10^{-4}, and β = 0.770. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures.

*T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}. ‡Values in parentheses are extrapolated or estimated.

FIGURE SHOWS ONLY 27 OF THE CURVES REPORTED IN TABLE

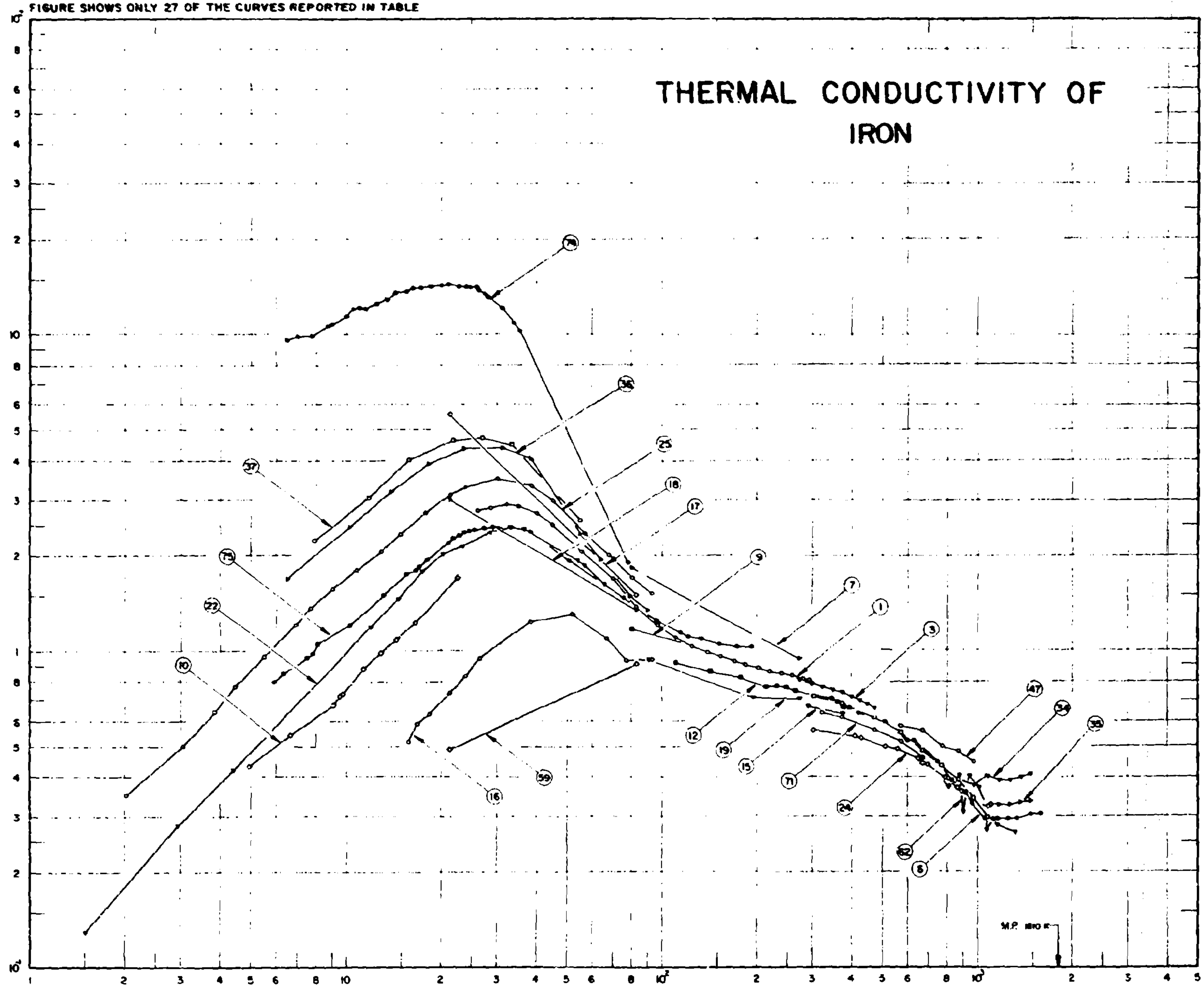


FIG. 24

SPECIFICATION TABLE NO. 24 THERMAL CONDUCTIVITY OF IRON

(Impurity < 0.20% each; total impurities < 0.50%)

(For Data Reported in Figure and Table No. 24)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	115	L	1951	26-292			99.99 pure; supplied by Johnston Mackay Ltd.
2	~~1010~~ 1014	L	1968	82-373	1.6	18 AF3	99.96 Fe, 0.007 Cu, 0.007 Ni, 0.0058 C, 0.004 Mn, 0.004 Si, 0.003 S, 0.0023 N, 0.002 Cr, 0.001 Al, 0.001 P, and 0.0008 O; 1.247 cm dia x 10.44 cm long; prepared by National Physical Laboratory, England; as received; density 7.872 g cm^{-3} at 24 C; electrical resistivity reported as 0.925, 5.26, 8.97, and 10.33 μohm cm at 77.78, 194.8, 273.3, and 298.8 K, respectively; Lorenz function reported as 1.625, 1.885, 2.420, 2.704, and 2.884 x 10^{-8} V^2 K^{-2} at 70.2, 100, 200, 300, and 389.8 K, respectively; measured in a vacuum of 5 x 10^{-6} torr.
3	1	L	1935	273-473	2		0.0045 C, 0.002 Mn, 0.0015 S, 0.001 P, 0.0006 Ni, 0.0002 Si, traces of Al and Mg; 1 cm dia x 15 cm long; density 7.871 ± 0.002 g cm^{-3}; electrical resistivity reported as 11.5, 14.5, and 17.8 μ ohm cm at 50, 100, and 150 C, respectively; data taken from smoothed curve.
4	129, 161	C	1933	373-772	5	Basic open hearth Iron	0.042 P, 0.03 Mn, 0.02 C, and 0.005 S; hot-rolled to 1 in. bar; high purity lead used as comparative material; data taken from smoothed curve.
5	5	L	1947	320-1016	1.95	Armco Iron	99.808 Fe (by difference), 0.067 Cu, 0.039 S, 0.035 Mn, 0.028 C, and 0.024 Ni; 2.50 cm dia x 8.00 cm long; machined from a hot-rolled 1.5 in. rod.
6	39	R	1958	371-1594	2	Armco Iron	Specimen consisted of three annular rings each of 0.625 in. I.D., 3.0 in. O.D., and 1 in. thick.
7	34	L	1927	80,273		Electrolyte iron; 1	Coarse-grained; electrical conductivity reported as 121 and 10.4 x 10^4 $ohm^{-1}cm^{-1}$ at 80 and 273 C, respectively.
8	34	L	1927	80,273		Electrolyte iron; 2	Fine-grained; electrical conductivity reported as 121 and 10.4 x 10^4 $ohm^{-1}cm^{-1}$ at 80 and 273 C, respectively.
9	34	L	1927	80,273		Electrolyte iron; 3	Obtained from Firma Heraeus; electrical conductivity reported as 61.2 and 9.4 x 10^4 $ohm^{-1}cm^{-1}$ at 80 and 273 C, respectively.
10	81	L	1939	4.9-23		Electrolyte iron	Extremely pure; 2.545 mm dia x 12.32 cm long; electrical resistivity ratio $\rho(273\ K)/\rho_0$ = 29.4.
11	21	R	1951	718-1008	± 1	Armco Iron	Annular cylindrical specimen of 1.5 in. I.D., 6 in. O.D., and 2.25 in. thick.
12	91	C	1951	111-394		Armco Iron	0.035 Cu, 0.026 S, 0.015 Mn, 0.014 C, and 0.004 P; 2 cm dia x 15 cm long; Armco iron used as comparative material.
13	69	L	1937	323-961	1	Armco Iron; 1	0.032 Mn, 0.03 S, 0.015 C, 0.013 Cu, 0.01 Si, and 0.003 P; 1.4 cm dia x 10 cm long; annealed at 950 C.
14	69	L	1937	304-943	1	Armco Iron; 2	Similar to the above specimen.
15	77	E	1900	291,373		Fe I	0.1 C; 1.3007 cm dia x 27.0 cm long; density 7.84 g cm^{-3} at 18 C; electrical conductivity reported as 8.357 and 5.950 x 10^4 $ohm^{-1}cm^{-1}$ at 18 and 100 C, respectively.

SPECIFICATION TABLE NO. 24 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
16	104	E	1951	16-93		6936	99.93 pure; forged; measured in a vacuum of 5 x 10^{-6} mm Hg.
17	57	L	1927	21,83		Fe 1	Electrolytically refined; cold-worked and annealed; electrical resistivity reported as 0.1681, 0.778, and 8.71 μohm cm at -252, -190, and 0 C, respectively.
18	57	L	1927	21,83		Fe 2	Technically pure; polycrystalline; electrolytically precipitated; electrical resistivity reported as 0.1437, 0.929, and 9.11 μohm cm at -252, -190, and 0 C, respectively.
19	79	E	1933	90-273		Armco Iron	0.056 Cu, 0.026 S, 0.017 Mn, 0.011 C, 0.006 P, and 0.002 Si; 0.3924 cm dia x 14.53 cm long; electrical resistivity reported as 1.531, 5.74, 9.57, and 15.49 μohm cm at -183.00, -78.50, 0, and 100 C, respectively.
20	699	L	1965	88-300			0.064 O, 0.0027 C, 0.002 S, 0.001 Mn, 0.001 N, 0.001 Si, and trace Cr; electrical resistivity as 1.22, 5.60, 6.50, 7.65, 8.96, 10.0, 11.3, 12.5, and 13.6 μohm cm at 83, 203, 223, 248, 273, 293, 313, 333, and 353 K, respectively.
21	89	C	1956	273-1273			99.906 Fe (by difference), 0.035 Cu, 0.026 S, 0.015 Mn, 0.014 C, and 0.004 P; measured in a vacuum of ~2 x 10^{-5} mm Hg; a section of the specimen used as comparative material.
22	83	L	1956	1.5-128		JM 5092	99.99 Fe; 0.005 Ni, 0.0002 Cu, 0.0001 Ag, traces of Mn and Mg; 2 mm dia rod supplied by Johnson Matthey and Co.; annealed at 750 C for 4 hrs in vacuo; electrical resistivity reported as 0.248 and 10.0 μohm cm at 4.2 and 293 K, respectively.
23	131	C	1953	323-1073	2	Swedish Iron	0.028 Si, 0.026 C, 0.021 P, 0.02 Mn, and 0.011 S; annealed in vacuum at 900 C; advance (55 Cu-45 Ni) used as comparative material.
24	71	L	1917	303-1107		Swedish Iron	Pure; cylindrical specimen of 1 cm dia x 8 cm long with a cavity of 6 mm dia x 16 mm long in its middle portion; electrical resistivity reported as 15.3, 20.0, 23.1, 26.3, 32.0, 36.4, 43.6, 45.3, 53.1, 61.6, 76.4, 80.7, 90.2, 92.1, 98.7, 100.0, 100.7, 102.2, 105.8, 108.6, 110.3, 111.3, 112.9, 113.8, 114.5, 115.1, 115.8, and 117.0 μohm cm at 30.94, 140, 183, 254, 302, 375, 390, 462, 527, 627, 660, 700, 709, 742, 746, 751, 760, 772, 789, 810, 817, 851, 851, 862, 888, 890, and 901 C, respectively.
25	122	L	1955	2.0-93	± 3	JM 4975; Fe 1	99.99 pure; polycrystal; 0.202 cm dia x 2.89 cm long; supplied by Johnson-Matthey; annealed in vacuo for several hours at two thirds the melting temperature; electrical resistivity ratio $\rho(293K)/\rho(20K)$ = 67.8.
26	110, 476	L	1934	273-1073	2	Armco Iron	99.918 Fe, 0.025 Mn, 0.023 C, 0.020 S, 0.007 P, and 0.007 Si; 2.895 in. dia x 84 in. long; made from two similar rods of Armco ingot iron each 3 in. dia x 42 in. long; electrical resistivity reported as 9.6, 15.0, 22.6, 31.4, 43.1, 55.3, 69.8, 87.0, and 105.5 μohm cm at 0, 100, 200, 300, 400, 500, 600, 700, and 800 C, respectively.
27	251, 260	P	1959	300-1298		Armco Iron; V	0.1875 in. dia x 2 in. long; machined from Armco stock supplied by Mapes and Sprowl Steel Co.; Curie point 770 C; transition point (α-γ) 910 C; measured in a vacuum of ~5 x 10^{-4} mm Hg; thermal conductivity values calculated from measured thermal diffusivity data and specific heat values taken from literature.
28	251	P	1959	295,1255		Armco Iron; IV	Similar to above.

SPECIFICATION TABLE NO. 24 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
29	1004		1966	629-973		Armco Iron	No details reported.
30	1005	E	1927	273.2			0.125 in. dia x 10 cm long; electrical resistivity 15.8 μohm cm at 0 C.
31	444	C	1939	512-1046		Armco Iron	99.918 Fe, 0.025 Mn, 0.023 C, 0.020 S, 0.007 P, and 0.007 Si; 1.28 cm dia x 14 cm long; machined; lower section of the specimen used as comparative material.
32	444	C	1939	730-1138		Armco Iron	Similar to above except specimen of 1 in. dia.
33	444	R	1939	369-1278		Armco Iron	Specimen consisted of two superimposed disks of 1.1 cm I.D., 6.3 cm O.D., and 2.54 cm thick, machined from the similar original rods as above.
34	163	L	1936	303-1473		D	0.05 Cu, 0.040 S, 0.02 Mn, 0.011 P, 0.01 C, and trace of Si.
35	163	L	1936	303-1473		PD 00	0.08 Mn, 0.022 S, 0.02 C, 0.016 P, and 0.01 Si.
36	253	L	1959	6.5-90		Electrolytic Iron; 1	28 x 2.5 x 2.5 mm; doubly refined; cut out of a precipitated plate, annealed at 950 C, compressed, and reannealed in vacuo at 950 C; electrical resistivity ratio $\rho(273\ K)/\rho_0$ = 84.7 ~104.2; residual electrical resistivity 0.09 ~0.10 μohm cm; specimen believed to be from the same material as that of Grüneisen, E. and Goens, E. (see curve No. 17).
37	253	L	1959	7.9-90		2	Similar to the above specimen except dimensions 30 x 2.4 x 1.7 mm, and electrical resistivity reported as 0.092, 0.097, 0.100, 0.106, 0.120, 0.269, 0.368, 0.631, 0.744, 1.06, and 10.3 μohm cm at 4.2, 15.2, 20.8, 26.1, 32.5, 54.4, 61.2, 74.2, 79.1, 90.2, and 293.0 K, respectively.
38	276	C	1953	343	3	Armco Iron	Pure; density (25 C) ~ 7.9 g cm^{-3}.
39	217	C	1959	410-1057	4	Armco Iron	99.745 Fe, 0.16 Cu, 0.03 C, 0.03 S, 0.015 Si, 0.01 Mn, and 0.01 P; obtained from commercial source in wrought form; iron used as comparative material (data of H.W. Deem).
40	64	L	1900	301, 331			99.93 Fe, 0.059 C; density 7.785 g cm^{-3}.
41	203	L	1957	300	± 1.5	Armco Iron	Commercial Armco iron; electrical conductivity 9.09 x 10^{4} ohm^{-1}cm^{-1} at 300 K.
42	340	L	1956	355-800	5	Armco Iron	0.75 in. dia rod.
43	97	L	1952	2.3-32	2-3	JM 4975; Fe 1	99.99 pure; 1-2 mm dia x ~5 cm long; supplied by Johnson Matthey; annealed.
44	445	L	1960	303-1273	± 2.5	Armco Iron	0.083 Cu, 0.030 Mn, 0.023 S, 0.006 P, 0.004 Si, 0.02 C; specimen in two halves each of length 7.156 cm and dia 2.324 cm; supplied by BMI; annealed for 0.5 hr at 850 C; electrical resistivity reported as 10.4, 15.6, 22.9, 32.0, 42.9, 55.7, 70.3, 87.9, 106.0, 112.0, and 115.3 μohm cm at 0, 100, 200, 300, 400, 500, 600, 700, 800, 900, and 1000 C, respectively; measured in a vacuum of 0.2-3 x 10^{-5} mm Hg.
45	446	R	1959	855-1198		Armco Iron	Specimen consisted of three stacked hollow cylinders each of 2.5 in. O.D. and 2.5 in. high.

SPECIFICATION TABLE NO. 21 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
46	356	R	1956	372-1172	± 7		Pure.
47	439	L	1935	373-973	2		0.034 Mn, 0.03 C, 0.012 S, 0.005 P, and 0.003 Si.
48	635	R	1957	373-1173	0.5		Pure.
49	625		1960	904-1108	± 14	Armco Iron	No details reported.
50	504	P	1961	295	± 5	Armco Iron	1.9 x 1.9 x 0.100 cm; thermal conductivity values calculated from measured data of thermal diffusivity and specific heat, and density 7.87 g cm^{-3} taken from Smithsonium Physical Tables (9th ed., 1954).
51	673	E	1932	289.6	± 1.3	Electrolytic iron	Wire specimen of 200 mm long.
52	591	C	1963	338.2	± 1.8		99.82 pure; 0.500 in. dia x 3 in. long; hot-rolled; measured in a vacuum of < 5 x 10^{-4} mm Hg; nickel-plated copper used as comparative material.
53	626	P	1960	995-1298	± 2	Armco Iron	0.1875 in. dia x 2 in. long; machined from rod stock Armco iron obtained from Mapes and Sprowl; thermal conductivity values calculated from measured thermal diffusivity data and specific heat values of Darken, L.S. and Smith, R.P. (Ind. Eng. Chem., 43, 1815, 1951).
54	627	R	1964	385-1292	± 4.9	Armco Iron	0.1 Cu, 0.1 Ni, 0.086 O, 0.05 Mn, < 0.05 Al, < 0.05 Cr, < 0.05 Mo, 0.023 S, < 0.02 Si, < 0.02 V, 0.013 C, < 0.01 Ti, 0.006 P, 0.0050 N, and < 0.0001 H; grain size 20-40 μ; electrical resistivity reported as 3.2, 5.3, 7.6, 10.2, 12.6, 15.9, 19.4, 23.3, 27.8, 32.7, 38.2, 44.0, 50.3, 56.7, 64.1, 72.0, 80.7, 90.2, 101.2, 108.7, 112.4, 114.5, 116.2, and 117.7 μohm cm at -150, -100, -50, 0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, and 1000 C, respectively; run no. 1.
55	627	R	1964	484-1198	± 4.9	Armco Iron	The above specimen; run No. 2A.
56	627	R	1964	973-1206	± 4.9	Armco Iron	The above specimen; run No. 2B.
57	627	R	1964	1206-1273	± 4.9	Armco Iron	The above specimen; run No. 2C.
58	527	R	1964	1025-1198	± 4.9	Armco Iron	The above specimen; run No. 2D.
59	57	L	1927	21,83		Fe 3	Polycrystalline; made by electrolytic method; hammered; tempered for 1 hr at 500 C; electrical conductivity reported as 1.060, 1.917, and 9.95 μohm cm at -252, -100, and 0 C, respectively.
60	664	E	1957	385-870	± 4	Armco Iron	0.045 S, 0.04 C, and 0.005 P; electrical resistivity reported as 16.36, 22.87, 32.13, 41.00, 53.48, 54.10, and 67.15 μohm cm at 111.7, 203, 301, 390, 493, 499, and 597 C, respectively.
61	634	R	1962	648-1263	± 10	Armco Iron	Specimen size 2 in. O.D., 3 in. long with a 0.5 in. center hole.
62	634	R	1962	753-1323	± 10	Armco Iron	The above specimen measured by using different heat sink.

SPECIFICATION TABLE NO. 21 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
63	661	R	1964	93-1273			0.012 O, 0.008 P, 0.007 C, 0.007 Al, 0.004 S, and 0.002 N; test disks annealed for several hrs at 900 C; electrical resistivity reported as 1.1, 1.7, 2.4, 3.1, 4.0, 5.0, 5.9, 6.9, 7.9, 8.8, 9.87, 11.6, 14.7, 18.1, 21.4, 26.0, 30.1, 35.0, 40.3, 46.8, 53.3, 60.1, 68.0, 76.0, 84.6, 94.2, 102.1, 106.3, 109.0, 111.1, and 113.1 μohm cm at -180, -160, -140, -120, -100, -80, -60, -40, -20, 0, 20, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, and 1000 C, respectively.
64	660	P	1964	273-1373		Armco Iron	Armco iron obtained from BMI; thermal conductivity values calculated from thermal diffusivity and specific heat using density value 7.874 g cm^{-3} given by Cleaves and Thompson measured data of (The Metal-Iron, McGraw-Hill, p. 271, 1935).
65	636	L	1954	316.2			0.01 Si, traces of Ni, Cu, Al, Mn, Mo, and Ti (in order of decreasing amounts); 0.4 cm dia x 3.5 cm long; prepared by repeated electrolyses, machined; density 7.874 g cm^{-3}.
66	629	R	1956	803-1048		Armco Iron	Disk specimen.
67	40, 43	L	1956	808-1153		Armco Iron	6.75 in. dia x 1.5 in. thick.
68	217		1959	373-773		Armco Iron	Measured by Robinson, H.E., NBS.
69	631	L, C	1962	73-1273		Armco Iron	99.834 (by difference) Fe, 0.083 Cu, 0.030 Mn, 0.023 S, 0.02 C, 0.006 P, and 0.004 Si; chemical and spectrographic analysis at NPL showed 0.083 Ni in addition to the above; 1 in. rod from American Rolling Mill Co. in hot-rolled condition; annealed for 30 min at 1600 F (871 C) in air, followed by furnace cooling; electrical resistivity reported as 1.5, 3.3, 5.3, 7.5, 10.0, 12.5, 15.6, 19.1, 23.0, 27.0, 31.2, 36.3, 41.8, 47.4, 54.0, 61.0, 68.8, 77.2, 86.2, 96.8, 105.2, 109.8, 112.4, 114.1, and 115.8 μohm cm at -200, -150, -100, -50, 0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, and 1000 C, respectively; data taken from smoothed curve.
70	632, 900	L	1963	113-913		Armco Iron	99.834 Fe (by difference), 0.083 Cu, 0.030 Mn, 0.023 S, 0.02 C, 0.006 P, and 0.004 Si; specimen 37 cm in length and 2.386 cm in dia; obtained from the American Rolling Mill Co. by Battelle Memorial Institute in the form of 1 in. rod; annealed for 1/2 hr at 1123 K; data taken from smoothed curve.
71	624		1959	323-673		Armco Iron	Polycrystalline.
72	633	L	1963	373-1273		Armco Iron	Corrected values for the temperature variation on the data (Curve 44) of Laubitz, 1960.
73	670	L	1965	6.5-198		A-I	99.998+ Fe, < 0.0020 O, < 0.0006 N, 0.0004 C, 0.00015 Co, 0.00011 Cu, 0.000065 Cr, 0.00002 Ti, 0.000019 Ge, and 0.000018 V; polycrystalline; specimen 0.305 cm in dia made from commercial electrolytic iron; fabricated by swaging to 0.483 cm dia with intermediate annealing treatments in Pd-purified hydrogen, and after the final annealing at 650 C for 1/2 hr, a 0.305 cm dia gauge section was chemically polished into the specimen; final equiaxed grain size about 0.1 mm; electrical resistivity ratio $\rho(297K)/\rho(4.2K) = 302$.

SPECIFICATION TABLE NO. 24 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
74	670	L	1965	6.5-78		A-II	The second run of the above specimen.
75	670	L	1965	6.0-193		B	99.925 Fe, 0.0230 C, 0.0140 O, 0.0116 S, 0.0100 Si, 0.0040 P, 0.0023 Cu, 0.0017 Ti, 0.0016 Zr, 0.0013 Ge, 0.0010 Ni, 0.0009 Cr, 0.0009 Mg, 0.0007 Mn, 0.0005 As, 0.0004 Co, and 0.0003 Ca; polycrystalline; specimen made by vacuum melting commercial electrolytic iron in the conventional fashion; annealed; electrical resistivity ratio, $\rho(297K)/\rho(4.2K) = 27.1$.
76	671	L	1961	100-280			"Very pure"; manufactured by Philips Research Labs, Eindhoven, Holland; wire 2.5 mm in dia; annealed at about 500 C for 10 hrs; electrical resistivity 9.8 μohm cm at 20 C.
77	671	L	1961	100-280			Spectroscopically standardized iron from Johnson, Matthey and Co.; rod 5.0 mm in dia; annealed at about 500 C for 10 hrs; electrical resistivity 9.9 μohm cm at 20 C.
78	695, 696	R	1965	425-773		Armco Iron	99.865 Fe (by difference), 0.07 Mn, 0.04 Si, 0.015 C, and 0.01 Cu; specimen consisted of two disks each with a length of 20 mm.
79	683		1963	0.42-0.95			99.97 pure; polycrystalline wire.
80	706	L	1881	273,373			Electrical conductivity 10.37 and 6.628 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100° C (author reported 10.37 and 6.628 x 10^5, probably a typographical error).
81	841	L	1967	316-483		Pure iron No. 1	0.0250 Ni, 0.0100 Cu, 0.0100 Mo, 0.0070 Cr, 0.0050 C, 0.0040 O, 0.0040 S, 0.0040 V, 0.0030 P, 0.0010 Mn, < 0.0010 Si, 0.0006 N, and 0.000048 H; 1.27 cm dia x 15 cm long; supplied by Metals Research; electrical resistivity reported as 11.7, 14.7, 17.9, 21.6, and 25.6 μohm cm at 50, 100, 150, 200, and 250 C, respectively.
82	841	L	1967	307-499		Pure iron No. 2	0.0055 Ni, 0.0053 Si, 0.0038 Al, 0.0035 S, 0.0020 Co, 0.0017 P, 0.0014 C, 0.0010 Cr, < 0.0010 Mn, 0.0008 O, 0.0007 N, and 0.000016 H; short rod of 1.27 cm dia; prepared by Metallurgy Division of National Physical Laboratory; machined from disk; electrical resistivity reported as 11.9, 14.5, 18.2, 21.8, 25.8, 30.3, 41.0, 53.3, 67.9, 85.2, and 104.2 μohm cm at 50, 100, 150, 200, 250, 300, 400, 500, 600, 700, and 800 C, respectively.
83	841	L	1967	323-573		Pure free iron	0.0800 Si, 0.0300 C, 0.0150 P, 0.0100 Mn, and 0.0100 S; 2.54 cm dia x 20 cm long; supplied by Low Moor Best Yorkshire Iron Limited; electrical resistivity reported as 15.8, 18.7, 22.0, 25.9, 30.0, 34.6, 45.0, 57.1, 71.0, 87.5, and 107.2 μohm cm at 50, 100, 150, 200, 250, 300, 400, 500, 600, 700, and 800 C, respectively.
84	894	R	1964	332-1173	1	High purity iron	0.001 ~ 0.01 Ni, 0.001 ~ 0.01 Si, 0.003 C, 0.003 S, 0.0025 O, 0.0011 P, 0.0001 ~ 0.001 Al, 0.0001 ~ 0.001 Ca, 0.0001 ~ 0.001 Cu, 0.0005 N, 0.0001 H; prepared by arc-melting Armco iron stock in pure inert atmosphere to produce pancake shaped billets, rolled into sheets and cut to make feed stock for electron-beam melting, then cast into 4 in. dia x 6 in. long billet, trimmed off outside edges and machined from center portion two disks of dimensions 3.25 in. dia x 1.130 in. thick and 3.25 in. dia x 1.450 in. thick, four Armco iron disks added as end backup disks to form specimen column of 9 in. high, consisted of six disks in total; electrical resistivity reported as 1.037, 5.17, 9.04, 10.35, 11.06, 14.74, 21.92, 30.67, 41.07, 53.98, 68.33, 85.85, 105.48, 109.45, 112.35, 112.47, 113.92, and 115.30 μohm cm at -200, -84, 0, 24.37, 100, 200, 300, 398, 501, 598, 700, 801, 850, 900, 925, 964, and 1000 C, respectively.

SPECIFICATION TABLE NO. 24 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
85	894	R	1964	1193-1273	1	High purity iron	2nd run of the above specimen.
86	894	R	1964	1166-1272	1	High purity iron	3rd run of the above specimen; after 2nd run, temperature raised to 1065 C and left overnight to stabilize thermocouples.
87	312	C	1963	349-926		Armco Iron	1 in. dia x 0.250 in. thick; Armco iron used as comparative material.
88	895	R	1964	373-1273			99.97 pure; disc shaped specimen 10.45 cm in dia with an axial hole 1.27 cm in dia; measured in a vacuum of 2 x 10^{-5} mm Hg.
89	477	L	1962	397-636		Armco Iron	Specimen supplied by Abeles, B.
90	321	P	1956	336-1269		Armco Iron	Thermal conductivity values calculated from the measured data of thermal diffusivity specific heat data of Darkin, L.S. and Smith, R.P., (Ind. Engr. Chem., 43, p. 1815, 1951) and the density of 7.867 g cm^{-3}.
91	916	R	1966	323-1273	± 1.5	High purity iron	99.95 Fe (approx); 0.002-0.02 Si, 0.014 C, 0.00095-0.0095 Ni, 0.0088 O, < 0.0056 H, 0.0052 S, 0.00021-0.0021 Al, 0.002 P, 0.002 N, 0.00014-0.0014 Ca, and 0.00009-0.0009 Cu; obtained by electron-beam melting Armco iron; electrical resistivity reported as 0.40, 1.01, 5.31, 9.04, 11.72, 14.70, 18.06, 21.84, 26.10, 30.72, 35.90, 41.51, 47.53, 54.12, 61.22, 68.89, 77.10, 86.22, 96.46, 105.53, 109.58, 112.56, 113.09, 112.54, 113.66, and 115.49 μ ohm cm at -269, -195.7, -79.1, 0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 910, 920, 950, and 1000 C, respectively.
92	1004	1966	636-1102				Pure.
93	1005	E	1927	273.2			0.125 in. dia x 10 cm long; electrical resistivity 15.8 μ ohm cm at 0 C; measured in a longitudinal magnetic field of 10000 gausses.
94	1005	E	1927	273.2			The above specimen measured in a transverse magnetic field of 4000 gausses.

DATA TABLE NO. 24 THERMAL CONDUCTIVITY OF IRON

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
26.05	2.787
28.55	2.833
32.25	2.904
35.15	2.866
40.05	2.732
45.00	2.510
56.70	2.054
69.90	1.619
82.60	1.385
96.75	1.209
111.02	1.100
111.45	1.100*
125.70	1.033
139.90	0.987
154.50	0.958
170.25	0.925
184.94	0.904
203.33	0.883
219.80	0.862
240.13	0.849
260.20	0.837
280.52	0.820
292.10	0.812
CURVE 2	
81.89	1.311
85.39	1.282
204.3	0.871
283.1	0.794
283.6	0.807*
283.7	0.808*
305.2	0.788
305.4	0.786*
371.3	0.738*
372.5	0.739*
CURVE 3	
273.2	0.812
298.2	0.791
323.2	0.774
348.2	0.753
373.2	0.736
398.2	0.720
CURVE 3 (cont.)	
423.2	0.699
448.2	0.678
473.2	0.661
CURVE 4*	
373.2	0.665
473.2	0.607
484.2	0.597
535.3	0.561
575.1	0.540
607.6	0.536
673.2	0.491
772.2	0.435
CURVE 5*	
319.5	0.729
340.9	0.717
363.0	0.705
382.0	0.694
385.5	0.693
390.0	0.686
405.6	0.676
411.0	0.674
424.3	0.660
491.3	0.616
526.8	0.589
530.9	0.590
560.4	0.569
571.5	0.562
596.5	0.546
620.4	0.532
631.5	0.523
676.4	0.497
706.5	0.480
706.9	0.479
743.3	0.462
776.0	0.447
808.7	0.429
837.1	0.415
880.4	0.395
904.6	0.379
939.2	0.364
CURVE 5 (cont.)	
973.9	0.347
1009.6	0.332
1015.5	0.329
CURVE 6	
371.2	0.687*
423.9	0.637
510.0	0.595
599.8	0.521
629.0	0.521
746.0	0.418
836.3	0.389
923.2	0.358
960.4	0.331
1054.7	0.294
1122.2	0.294
1160.8	0.294
1252.0	0.294
1334.0	0.294
1477.0	0.303
1593.7	0.305
CURVE 7	
80	1.839
273	0.944
CURVE 8*	
80	1.828
273	0.899
CURVE 9	
80	1.173
273	0.823
CURVE 10	
4.94	0.431
6.65	0.542
9.12	0.671
9.53	0.720
CURVE 10 (cont.)	
9.75	0.729
11.33	0.876
12.81	0.982
14.40	1.070
16.54	1.230
22.50	1.710
CURVE 11*	
718.2	0.456
783.2	0.444
884.2	0.389
1008.2	0.331
CURVE 12	
111.0	0.916
143.7	0.862
178.2	0.828
214.5	0.774
214.6	0.770
231.4	0.778
248.2	0.774
265.3	0.749
344.8	0.707
360.6	0.690
376.9	0.665
393.6	0.661
CURVE 13*	
322.6	0.699
335.1	0.686
379.3	0.661
408.1	0.644
431.6	0.623
450.8	0.615
480.0	0.598
515.7	0.569
547.8	0.552
566.9	0.536
601.5	0.515
616.1	0.510
645.3	0.485
CURVE 13 (cont.)*	
683.5	0.460
738.6	0.435
788.4	0.406
841.9	0.389
882.5	0.389
921.9	0.385
960.7	0.377
CURVE 14*	
301.4	0.699
325.6	0.695
337.7	0.682
365.6	0.669
386.4	0.653
429.2	0.632
441.7	0.615
474.8	0.598
492.0	0.577
538.5	0.556
592.7	0.519
643.4	0.481
693.4	0.452
715.9	0.444
740.9	0.427
783.0	0.406
822.4	0.393
862.6	0.385
904.3	0.381
943.3	0.372
CURVE 15	
291.2	0.670
373.2	0.634
CURVE 16	
15.77	0.518
16.79	0.586
19.35	0.634
21.37	0.738
23.85	0.838
26.40	0.945
CURVE 16 (cont.)	
38.40	1.224
52.00	1.305
67.10	1.099
76.80	0.931
93.00	0.935
CURVE 17	
21.2	3.610
83.2	1.505
CURVE 18	
21.2	3.010
83.2	1.360
CURVE 19	
90.2	0.937
194.7	0.715
273.2	0.707
CURVE 20	
[illegible]	1.40
90	1.35
95	1.27
106	1.16
123	1.07
137	1.01
167	0.93
203	0.90
225	0.86
300	0.81
CURVE 21*	
273.2	0.753
373.2	0.678
473.2	0.611
573.2	0.552
673.2	0.493
773.2	0.443
873.2	0.398
973.2	0.360
CURVE 21 (cont.)*	
1073.2	0.330
1173.2	0.348
1273.2	0.363
CURVE 22	
1.50	0.130
2.95	0.280
4.40	0.420
11.90	1.190
14.55	1.460
17.40	1.770
20.20	2.010
23.30	2.140
28.60	2.375
33.00	2.460
36.65	2.425
54.05	1.920
56.70	1.855
65.50	1.630
75.50	1.470
91.00	1.275*
110.5	1.120*
128.0	1.060*
CURVE 23*	
323.2	0.690
373.2	0.662
473.2	0.606
573.2	0.552
673.2	0.494
773.2	0.438
873.2	0.384
973.2	0.330
1073.2	0.274
CURVE 24	
303.2	0.561
410.2	0.536
427.2	0.531
507.2	0.498
559.2	0.490
CURVE 24 (cont.)	
648.2	0.456
674.2	0.443
695.2	0.439
789.2	0.397
861.2	0.368
886.2	0.360
905.2	0.360*
933.2	0.356*
983.2	0.351*
1032.2	0.326*
1085.2	0.322
1107.2	0.326
CURVE 25	
2.03	0.350
3.05	0.500
3.85	0.640
4.45	0.770
5.50	0.960
6.90	1.200
7.70	1.370
9.05	1.580
10.85	1.790
12.90	2.060
14.80	2.350
17.85	2.730
21.30	3.110
23.73	3.300
30.22	3.500
38.55	3.330
45.03	2.980
57.00	2.360
68.00	2.000
80.20	1.700
93.30	1.520
CURVE 26*	
273.2	0.750
373.2	0.686
473.2	0.619
573.2	0.552
673.2	0.490

*Not shown on plot

DATA TABLE NO. 24 (continued)

CURVE 26 (cont.)

T	k
773.2	0.440
873.2	0.398
973.2	0.356
1073.2	0.314

CURVE 27*

T	k
309.3	0.711
300.4	0.715
307.9	0.702
425.3	0.614
518.0	0.550
626.2	0.489
712.2	0.462
817.8	0.431
826.2	0.416
894.4	0.394
932.1	0.365
994.9	0.348
1010.2	0.349
1012.7	0.345
1036.9	0.279
1047.1	0.295
1052.9	0.290
1069.0	0.290
1094.2	0.292
1114.6	0.294
1131.1	0.284
1140.7	0.294
1144.7	0.291
1162.2	0.298
1171.2	0.305
1187.7	0.279
1190.9	0.286
1223.2	0.277
1229.8	0.278
1281.0	0.288
1285.2	0.289
1297.7	0.284

CURVE 28*

T	k
294.7	0.720
1255.9	0.278

CURVE 29

T	k
629.2	[illegible]
779.2	[illegible]
880.2	[illegible]
882.2	[illegible]
895.2	[illegible]
906.2	[illegible]
957.2	[illegible]
969.2	[illegible]
973.2	[illegible]

CURVE 30

T	k
[illegible]	0.774

CURVE 31*

T	k
512.2	0.585
723.2	0.462
847.2	0.406
885.2	0.385
893.2	0.369
951.2	0.345
1001.2	0.326
1046.2	0.308

CURVE 32*

T	k
730.2	0.452
856.2	0.384
992.2	0.332
1058.2	0.293
1082.2	0.2925
1138.2	0.280

CURVE 33*

T	k
369.2	0.683
411.2	0.649
466.2	0.608
538.2	0.566
604.2	0.538
607.2	0.521
610.2	0.512
691.2	0.486

CURVE 33 (cont.)*

T	k
791.2	0.416
792.2	0.428
846.2	0.397
903.2	0.383
906.2	0.374
955.2	0.339
1017.2	0.333
1025.2	0.321
1037.2	0.312
1046.2	0.305
1058.2	0.320
1061.2	0.298
1073.2	0.300
1082.2	0.289
1096.2	0.292
1126.2	0.277
1136.2	0.293
1139.2	0.2774
1168.2	0.277
1186.2	0.277
1192.2	0.271
1225.2	0.274
1278.2	0.277

CURVE 34

T	k
303.2	0.724*
323.2	0.711*
373.2	0.674*
473.2	0.611*
573.2	0.548*
673.2	0.490*
773.2	0.435*
873.2	0.399*
973.2	0.377
1073.2	0.402
1173.2	0.389
1273.2	0.389
1373.2	0.398
1473.2	0.406

CURVE 35

T	k
303.2	0.527*

CURVE 35 (cont.)

T	k
323.2	0.527*
373.2	0.527*
473.2	0.515*
573.2	0.485*
673.2	0.452*
773.2	0.410*
873.2	0.377*
973.2	0.347*
1073.2	0.331*
1173.2	0.326
1273.2	0.326
1373.2	0.331
1473.2	0.335

CURVE 36

T	k
6.5	1.6
10.3	2.46
13.8	3.17
18.2	3.91
23.6	4.36
31.3	4.37
38.3	4.06
54.8	2.36
63.8	1.94
79.3	1.49
90.3	1.35

CURVE 37

T	k
7.9	2.22
11.7	3.04
15.8	4.02
21.7	4.64
26.9	4.74
33.3	4.48
54.8	2.57
61.5	2.06
70.1	1.74
74.5	1.62
79.8	1.55
90.3	1.30

CURVE 38*

T	k
343.2	0.686

CURVE 39*

T	k
409.5	0.632
437.0	0.644
463.2	0.615
473.1	0.607
506.6	0.586
511.0	0.590
515.4	0.594
529.4	0.577
544.7	0.556
550.8	0.548
573.2	0.518
583.6	0.543
605.2	0.531
629.6	0.510
638.5	0.498
666.8	0.481
713.0	0.460
740.9	0.448
750.6	0.444
772.4	0.435
835.9	0.414
890.9	0.381
891.0	0.385
977.8	0.347
1056.5	0.318

CURVE 40*

T	k
301.4	0.633
331.5	0.632

CURVE 41*

T	k
300	0.690

CURVE 42*

T	k
354.7	0.684
355.4	0.706
392.1	0.673

CURVE 42 (cont.)

T	k
395.4	0.658
414.3	0.639
416.5	0.630
421.4	0.674
421.4	0.704
475.2	0.668
474.3	0.680
503.6	0.599
504.3	0.623
520.9	0.633
[illegible]	0.645
539.2	0.561
559.2	0.576
591.3	0.562
597.6	0.588
678.4	0.492
679.8	0.516
681.4	0.504
795.4	0.431
799.8	0.431

CURVE 43

T	k
2.3	0.25
3.4	0.37
4.0	0.475
5.8	0.565
7.6	0.79
9.4	1.02
11.3	1.16
14.5	1.42
16.8	1.68
21.1	2.0
22.2	2.09
24.2	2.22
26.3	2.31
28.1	2.43
29.8	2.42
32.4	2.48

CURVE 44*

T	k
303.2	0.691
373.2	0.647

CURVE 44 (cont.)*

T	k
473.2	0.584
573.2	0.528
673.2	0.474
773.2	0.427
873.2	0.383
973.2	0.340
1073.2	0.305
1173.2	0.291
1273.2	0.303

CURVE 45*

T	k
655.4	0.426
873.2	0.408
927.6	0.374
973.2	0.343
983.2	0.336
1052.6	0.317
1073.2	0.312
1122.1	0.312
1169.3	0.312
1173.2	0.315
1197.6	0.322

CURVE 46*

T	k
373.2	0.678
573.2	0.552
773.2	0.431
1173.2	0.272

CURVE 47

T	k
373.2	0.690*
473.2	0.657*
573.2	0.577
673.2	0.556
773.2	0.498
873.2	0.481
973.2	0.448

*Not shown on plot

DATA TABLE NO. 24 (continued)

CURVE 48*

T	k
373.2	0.682
573.2	0.552
773.2	0.427
1173.2	0.270

CURVE 49*

T	k
904.2	0.360
944.2	0.344
955.2	0.333
973.2	0.326
1002.2	0.317
1002.2	0.311
1035.2	0.300
1035.2	0.292
1076.2	0.291
1076.2	0.283
1108.2	0.293
1108.2	0.285

CURVE 50*

T	k
295.2	0.669

CURVE 51

T	k
289.2	0.661

CURVE 52

T	k
338.2	0.711

CURVE 53*

T	k
995.2	0.348
1010.7	0.349
1013.2	0.342
1047.2	0.296
1062.2	0.292
1069.2	0.291
1094.2	0.291
1114.7	0.295
1130.7	0.286
1140.2	0.296
1144.7	0.292
1161.2	0.300
1171.2	0.306

CURVE 53 (cont.)*

T	k
1188.2	0.28
1191.2	0.296
1223.2	0.279
1230.2	0.283
1281.2	0.288
1285.2	0.287
1298.2	0.286

CURVE 54*

T	k
385.2	0.6574
483.2	0.5966
573.2	0.5314
673.2	0.4806
773.2	0.4242
773.2	0.4231
873.2	0.3787
873.2	0.3790
971.2	0.3329
971.2	0.3333
990.2	0.3237
990.2	0.3243
1014.2	0.3122
1014.2	0.3121
1053.2	0.2937
1053.2	0.2936
1092.2	0.2914

CURVE 55

T	k
484.2	0.6002
572.2	0.5412
774.2	0.4294
774.2	0.4296
1024.2	0.3087
1069.2	0.2899
1091.2	0.2915
1111.2	0.2895
1111.2	0.2896
1169.2	0.2902
1198.2	0.2895
1218.2	0.2855

CURVE 56*

T	k
973.2	0.3381
1049.2	0.2993
1091.2	0.2931
1091.2	0.2934
1135.2	0.2947
1169.2	0.2946
1169.2	0.2951
1181.2	0.2955
1196.2	0.2838
1206.2	0.2851

CURVE 57*

T	k
1206.2	0.2881
1242.2	0.2925
1273.2	0.2938

CURVE 58*

T	k
1025.2	0.3129
1025.2	0.3128
1122.2	0.2960
1171.2	0.2982
1198.2	0.2867

CURVE 59

T	k
21.2	0.49
83.2	0.907

CURVE 60*

T	k
384.9	0.659
476.2	0.603
574.2	0.547
663.2	0.509
766.2	0.460
772.2	0.460
870.2	0.418

CURVE 61*

T	k
648.2	0.51
748.2	0.44
853.2	0.38
1038.2	0.30
1263.2	0.26

CURVE 62

T	k
753.2	0.415*
813.2	0.37
846.2	0.405
873.2	0.395
878.2	0.405
903.2	0.309
943.2	0.40
1008.2	0.37
1073.2	0.33
1073.2	0.27
1128.2	0.29
1163.2	0.28
1323.2	0.265

CURVE 63*

T	k
93.2	1.40
113.2	1.13
133.2	1.03
153.2	0.967
173.2	0.921
193.2	0.901
213.2	0.880
233.2	0.859
253.2	0.841
273.2	0.822
293.2	0.81
323.2	0.777
373.2	0.731
423.2	0.685
473.2	0.640
523.2	0.599
573.2	0.561
623.2	0.530
673.2	0.500
723.2	0.469
773.2	0.440
823.2	0.412
873.2	0.387
923.2	0.366
973.2	0.347
1023.2	0.331
1073.2	0.320
1123.2	0.310
1173.2	0.301
1223.2	0.274
1253.2	0.271
1273.2	0.271

CURVE 64*

T	k
273.2	0.755
323.2	0.723
373.2	0.688
423.2	0.654
473.2	0.617
523.2	0.580
573.2	0.543
623.2	0.508
673.2	0.475
723.2	0.444
773.2	0.419
823.2	0.397
873.2	0.377
923.2	0.357
973.2	0.339
1023.2	0.322
1038.2	0.317
1073.2	0.293
1123.2	0.293
1173.2	0.285
1223.2	0.289
1273.2	0.299
1323.2	0.310
1373.2	0.322

CURVE 65

T	k
316.2	0.774

CURVE 66

T	k
803.2	0.425
864.2	0.396
966.2	0.345
1048.2	0.313

CURVE 67

T	k
808.2	0.415
1086.6	0.286
1152.6	0.291

CURVE 68

T	k
373.2	0.657
473.2	0.598
573.2	0.540
673.2	0.485
773.2	0.427

CURVE 69*

T	k
73.2	0.959
123.2	0.879
173.2	0.820
223.2	0.77[illegible]
273.2	0.747
323.2	0.719
373.2	0.686
423.2	0.654
473.2	0.621
523.2	0.588
573.2	0.555
623.2	0.525
673.2	0.492
723.2	0.460
773.2	0.430
823.2	0.405
873.2	0.382
923.2	0.359
973.2	0.339
1023.2	0.316
1073.2	0.294
1123.2	0.282
1173.2	0.282
1223.2	0.287
1273.2	0.293

CURVE 70*

T	k
113.2	0.887
123.2	0.873
173.2	0.815
223.2	0.775
273.2	0.742
323.2	0.712
373.2	0.682
423.2	0.652
473.2	0.620
523.2	0.587
573.2	0.554
623.2	0.523
673.2	0.495
723.2	0.469
773.2	0.443
823.2	0.417
873.2	0.391
913.2	0.371

CURVE 71

T	k
323.2	0.640
373.2	0.615
473.2	0.561
573.2	0.519
673.2	0.464

CURVE 72*

T	k
373.2	0.655
473.2	0.594
573.2	0.538
673.2	0.484
773.2	0.437
873.2	0.394
973.2	0.349
1073.2	0.310
1173.2	0.290
1273.2	0.302

CURVE 73

T	k
6.4	10.5
6.5	11.3
6.8	10.8
7.0	11.0
7.2	11.9
7.2	12.05*
8.2	12.6
8.9	12.7
9.0	12.9*
10.0	13.1
11.5	13.6
11.6	14.05
12.5	13.95
13.0	14.95
15.5	15.1
17.0	15.15
18.2	15.4
20.0	15.7
20.7	15.55
21.2	15.75
22.0	15.6
24.0	15.4
24.8	15.2
26.0	15.3
27.8	14.15
30.2	12.95
36.4	9.66
39.8	8.10

* Not shown on plot

DATA TABLE NO. 24 (continued)

T	k
CURVE 73 (cont.)	
43.3	6.75
47.3	5.47
50.7	4.64
53.8	4.07
57.7	3.48
62.3	2.95
70.7	2.33
81.7	1.87
86.5	1.74
91.5	1.64
96.5	1.53
101.3	1.46
106.1	1.42*
110.9	1.37
115.7	1.33*
120.5	1.30
125.2	1.26*
130.0	1.24
134.0	1.22*
139.6	1.20
144.5	1.18*
149.3	1.17
154.1	1.15*
158.9	1.14
163.6	1.13*
168.1	1.12
173.6	1.12*
178.5	1.11
183.3	1.11*
188.0	1.11
192.9	1.10*
197.8	1.10
CURVE 74	
6.5	9.55
7.0	9.8
7.8	9.85
8.8	10.65
9.0	10.7
10.0	11.5
10.5	12.1
10.7	12.15*
11.0	12.2
11.5	12.15
11.8	12.6*

T	k
CURVE 74 (cont.)	
12.5	12.55
12.8	12.6*
13.5	13.0
14.3	13.6
15.5	13.75
16.2	14.1
17.3	14.1
18.6	14.3
20.0	14.4
21.0	14.5
21.5	14.4*
22.8	14.35
23.9	14.3
24.1	14.15
25.9	14.2
26.3	13.9
27.5	13.6
28.1	13.35
31.2	12.3
33.9	10.9
35.4	10.2
78.4	1.91
CURVE 75	
5.9	0.8
6.3	0.85
7.5	0.95
7.8	0.98
8.1	1.05
10.2	1.2
13.1	1.5
15.5	1.75
16.6	1.8
17.0	1.85
17.5	1.87*
18.0	1.95
18.5	1.95*
21.0	2.2
21.8	2.27
22.7	2.32
23.6	2.37
24.5	2.40
25.4	2.43
27.2	2.46
29.1	2.49

T	k
CURVE 75 (cont.)	
38.3	2.39
50.6	1.92
73.6	1.52*
88.7	1.32*
96.1	1.26
115.4	1.14
121.2	1.11
134.4	1.09
153.6	1.05
173.0	1.03
192.5	1.02
CURVE 76*	
100	1.170
202	0.894
280	0.815
CURVE 77*	
100	1.157
202	0.885
280	0.808
CURVE 78*	
425.2	0.651
485.2	0.588
537.2	0.568
591.2	0.522
697.2	0.447
773.2	0.438
CURVE 79*	
0.420	0.00296
0.440	0.00301
0.535	0.00400
0.584	0.00450
0.638	0.00480
0.700	0.00500
0.725	0.00510
0.780	0.00530
0.835	0.00553
0.900	0.00600
0.950	0.00650

T	k
CURVE 80*	
273.2	0.697
373.2	0.681
CURVE 81*	
315.5	0.758
318.6	0.766
324.5	0.759
332.7	0.750
341.9	0.745
345.2	0.747
360.8	0.735
372.0	0.735
385.3	0.716
399.7	0.708
405.4	0.706
426.2	0.685
429.3	0.675
433.8	0.678
443.4	0.666
465.7	0.651
483.3	0.638
CURVE 82*	
306.7	0.756
311.1	0.758
318.9	0.754
345.6	0.735
366.8	0.719
378.7	0.713
416.3	0.684
451.8	0.651
471.0	0.631
475.9	0.635
487.1	0.629
498.5	0.621
CURVE 83*	
323.4	0.610
373.1	0.599
424.1	0.588
473.4	0.571
523.8	0.551
573.2	0.530

T	k
CURVE 84*	
332.2	0.7367
384.2	0.6898
470.2	0.6223
563.2	0.5633
643.2	0.5072
723.2	0.4603
804.2	0.4201
887.2	0.3782
973.2	0.3382
1027.2	0.3121
1069.2	0.2973
1121.2	0.2958
1173.2	0.2964
CURVE 85*	
1193.2	0.2828
1231.2	0.2871
1273.2	0.3017
CURVE 86*	
1166.2	0.2966
1193.2	0.2837
1210.2	0.2822
1232.2	0.2866
1272.2	0.3000
CURVE 87*	
349.2	0.678
462.2	0.649
536.2	0.569
647.2	0.502
710.2	0.490
793.2	0.439
926.2	0.335
CURVE 88*	
373.2	0.718
473.2	0.640
573.2	0.570
673.2	0.498
773.2	0.442
873.2	0.392

T	k
CURVE 88 (cont.)*	
973.2	0.343
1073.0	0.295
1173	0.295
1193	0.281
1273	0.297
CURVE 89*	
397.2	0.649
403.2	0.632
415.2	0.598
420.2	0.594
503.2	0.561
510.2	0.556
561.2	0.531
567.2	0.531
567.2	0.523
631.2	0.494
636.2	0.490
CURVE 90*	
336.2	0.700
344.2	0.656
352.2	0.679
354.2	0.691
386.2	0.646
447.2	0.630
490.2	0.603
496.2	0.616
539.2	0.582
599.2	0.546
627.2	0.533
645.2	0.520
659.2	0.524
669.2	0.521
679.2	0.517
691.2	0.511
695.2	0.520
710.2	0.478
714.2	0.498
716.2	0.507
725.2	0.495
742.2	0.474
754.2	0.477
765.2	0.479

T	k
CURVE 90 (cont.)	
766.2	0.454
775.2	0.470
780.2	0.490
786.2	0.444
799.2	0.461
806.2	0.498
824.2	0.452
844.2	0.469
888.2	0.469
893.2	0.408
939.2	0.439
949.2	0.419
968.2	0.423
985.2	0.375
998.2	0.390
1015.2	0.386
1017.2	0.402
1035.2	0.349
1045.2	0.289
1055.2	0.231
1060.2	0.277
1066.2	0.295
1066.2	0.322
1085.2	0.307
1090.2	0.279
1105.2	0.298
1120.2	0.277
1127.2	0.314
1157.2	0.295
1165.2	0.290
1186.2	0.287
1195.2	0.287
1210.2	0.281
1221.2	0.290
1229.2	0.282
1239.2	0.274
1254.2	0.272
1269.2	0.281
CURVE 91*	
323.2	0.748
373.2	0.698
473.2	0.621
573.2	0.555
673.2	0.489

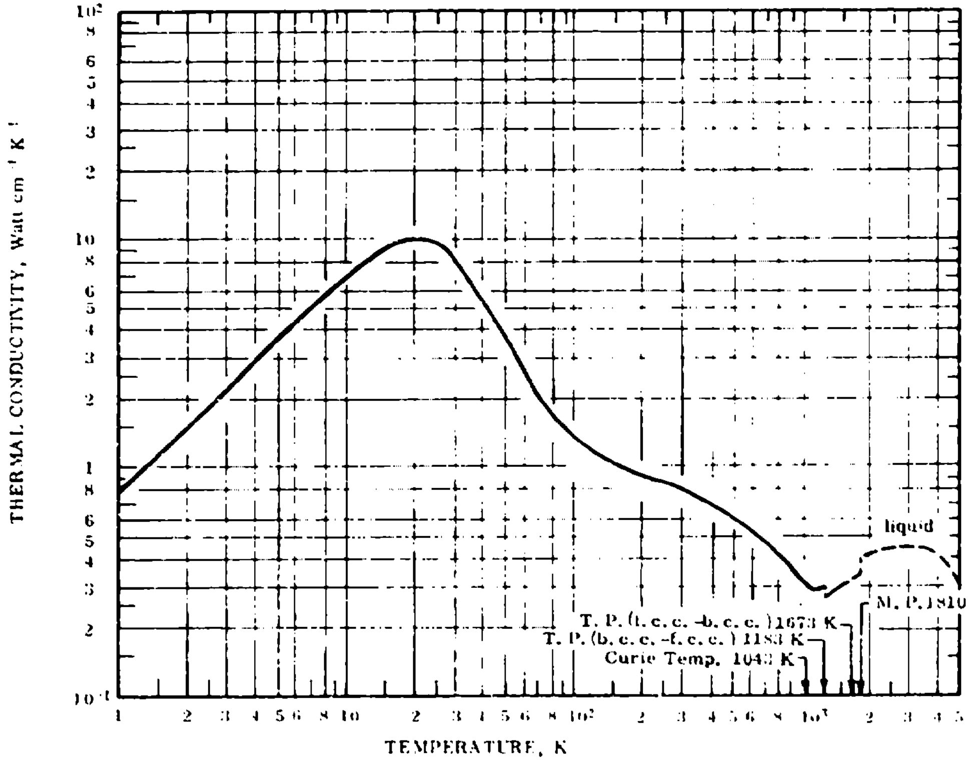
*Not shown on plot

DATA TABLE NO. 24 (continued)

T	k
CURVE 91 (cont.)*	
773.2	0.436
873.2	0.386
973.2	0.318
1023.2	0.313
1073.2	0.297
1123.2	0.296
1173.2	0.296
1183.2	0.297
1193.2	0.280
1223.2	0.287
1273.2	0.298
CURVE 92*	
636.2	0.497
733.2	0.467
833.2	0.409
919.2	0.368
930.2	0.370
1008	0.331
1096	0.303
1102	0.310
CURVE 93*	
273.2	0.765
CURVE 94*	
273.2	0.771

* Not shown on plot

FIGURE AND TABLE NO. 24R-1 RECOMMENDED THERMAL CONDUCTIVITY OF IRON



REMARKS

The recommended values are for well-annealed 99.998⁺% pure iron with residual electrical resistivity ρ_0 = 0.0327 μΩ cm (characterization by ρ_0 becomes important below room temperature). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.10, a = 0.37, m = 2.47, α'' = 2.05 x 10^{-6}, and β = 1.34. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature, and 3 to 8% at other temperatures.

RECOMMENDED VALUES*

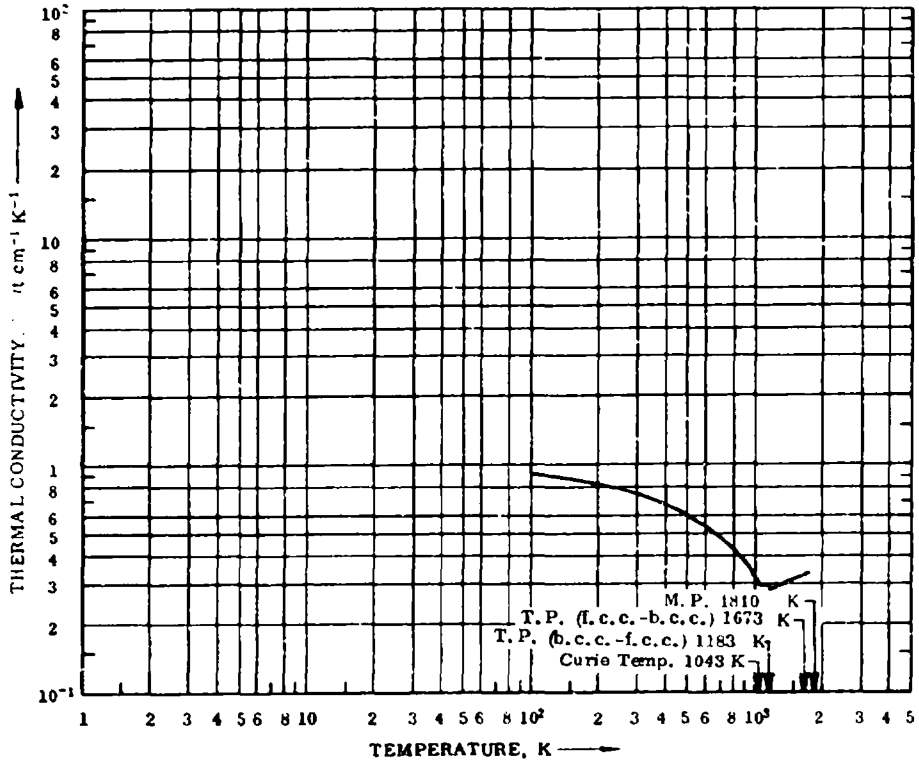
T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.75)‡	(43.3)	-457.9
2	1.49	86.1	-456.1
3	2.24	129	-454.3
4	2.97	172	-452.5
5	3.71	214	-450.7
6	4.42	255	-448.9
7	5.13	296	-447.1
8	5.80	335	-445.3
9	6.45	373	-443.5
10	7.05	407	-441.7
11	7.62	440	-439.9
12	8.13	470	-438.1
13	8.58	496	-436.3
14	8.97	518	-434.5
15	9.30	537	-432.7
16	9.56	552	-430.9
18	9.88	571	-427.3
20	9.97	575	-423.7
25	9.36	541	-414.7
30	8.14	470	-405.7
35	6.81	393	-396.7
40	5.55	321	-387.7
45	4.50	260	-378.7
50	3.72	215	-369.7
60	2.65	153	-351.7
70	2.04	118	-333.7
80	1.68	97.1	-315.7
90	1.46	84.4	-297.7
100	1.32	76.3	-279.7
150	1.04	60.1	-189.7
200	0.94	54.3	-99.7
250	0.865	50.0	-9.7
273.2	0.835	48.2	32.0
300	0.803	46.4	80.3
350	0.744	43.0	170.3
400	0.694	40.1	260.3

T_1	k_1	k_2	T_2
500	0.613	35.4	440.3
600	0.547	31.6	620.3
700	0.487	28.1	800.3
800	0.433	25.0	980.3
900	0.380	22.0	1160
1000	0.326	18.8	1340
1059	0.296	17.1	1447
1100	0.297	17.2	1520
1183	0.299	17.3	1670
1183	0.279	16.1	1670
1200	0.282	16.3	1700
1300	0.299	17.3	1880
1400	0.309	17.9	2060
1500	0.318	18.4	2240
1600	(0.327)	(18.9)	2420
1673	(0.334)	(19.3)	2552
1700	(0.336)	(19.4)	2600
1800	(0.345)	(19.9)	2780
1810	(0.346)	(20.0)	2798
In Liquid State			
1810	(0.403)	(23.3)	2798
1900	(0.415)	(24.0)	2960
2000	(0.426)	(24.6)	3140
2200	(0.441)	(25.5)	3500
2400	(0.450)	(26.0)	3860
2600	(0.455)	(26.3)	4220
2800	(0.458)	(26.5)	4580
3000	(0.458)	(26.5)	4940
3200	(0.456)	(26.3)	5300
3400	(0.451)	(26.1)	5660
3600	(0.442)	(25.5)	6020
3800	(0.430)	(24.8)	6380
4000	(0.415)	(24.0)	6740
4500	(0.368)	(21.3)	7640
5000	(0.308)	(17.8)	8540
5500	(0.233)	(13.5)	9440
6000	(0.147)	(8.49)	10340
6500	(0.051)	(2.95)	11240
6750	(~0)	(~0)	11690

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or estimated.

FIGURE AND TABLE NO. 24R-2 RECOMMENDED THERMAL CONDUCTIVITY OF ARMCO IRON
[Typical composition: 0.09 O; 0.08 Cu, Ni each; < 0.05 Al, Cr, Mn, Mo each; 0.015 C, S, Si, Ti, V each; 0.005 N, P each; 0.0001 H]



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
100	0.913	52.8	-279.7
150	0.854	49.3	-189.7
200	0.804	46.5	- 99.7
250	0.764	44.1	- 9.7
273.2	0.747	43.2	32.0
300	0.727	42.0	80.3
350	0.691	39.9	170.3
400	0.657	38.0	260.3
500	0.593	34.3	440.3
600	0.531	30.7	620.3
700	0.473	27.3	800.3
800	0.422	24.4	980.3
900	0.372	21.5	1160
1000	0.323	18.7	1340
1059	0.293	16.9	1446
1100	0.294	17.0	1520
1180	0.296	17.1	1664
1190	0.286	16.5	1682
1200	0.287	16.6	1700
1300	0.296	17.1	1880
1400	0.305	17.6	2060
1500	0.314	18.1	2240
1600	(0.322)‡	(18.6)	2420
1700	(0.330)	(19.1)	2600
1800	(0.338)	(19.5)	2780

REMARKS

The recommended values are thought to be accurate to within 3% of the true values below room temperature, 2% from room temperature to about 1000 K, and 3 to 8% from 1000 to 1600 K.

* T_1 in K, k_1 in Watt $cm^{-1} K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$.

‡ Values in parentheses are extrapolated.

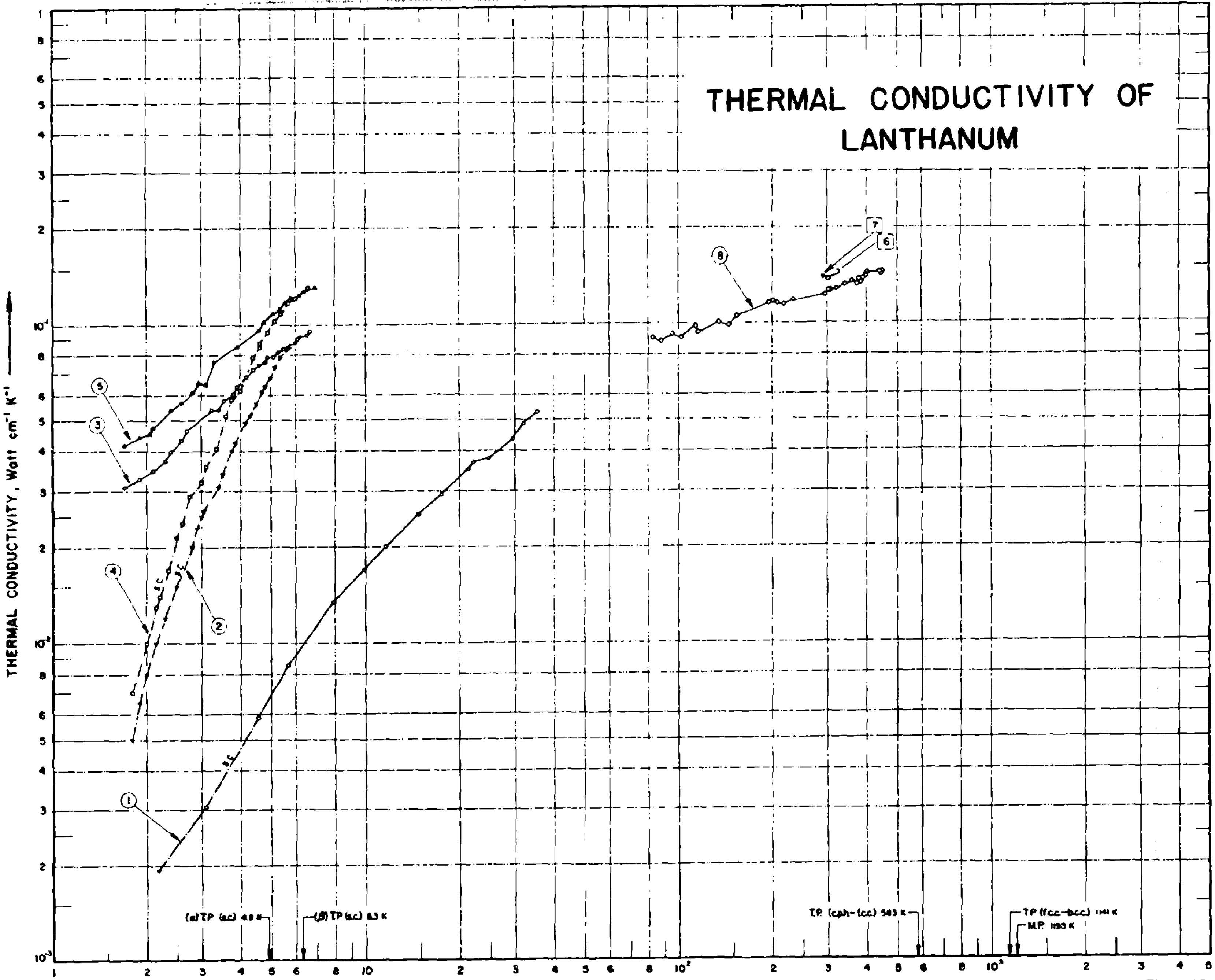

THERMAL CONDUCTIVITY OF LANTHANUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
(α) TP (s.c.) 4.8 K
(β) TP (s.c.) 6.3 K
T.P. (cph–fcc) 583 K
TP (fcc–bcc) 1141 K
M.P. 1193 K
s.c.

FIG 25

SPECIFICATION TABLE NO. 25 THERMAL CONDUCTIVITY OF LANTHANUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 25]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	122	L	1955	2.2–36		La I	99.94 pure; Ca and Be as major impurities; polycrystalline; superconducting below 4.7 K.
2	762	L	1965	1.8–6.6		La I	99.99 nominal purity; polycrystalline rod, of f.c.c. form; 5 cm long, 0.4 cm in dia; supplied by H. Fleishman Ltd.; annealed at 600 C for 24 hrs; residual electrical resistivity ρ(4.2 K) 1.72 μohm cm; electrical resistivity ratio ρ(293 K)/ρ(4.2 K) = 32.4; specimen in superconducting state below the transition point of 6.04 K (determined magnetically); x-ray analysis showed a trace of h.c.p. phase dispersed in the f.c.c. phase.
3	762	L	1965	1.7–6.7		La I	The above specimen measured in a magnetic field of 6600 gauss; specimen in normal conducting state; Lorenz number, L_0 = 2.79 x 10^{-8} V^2 K^{-2}.
4	762	L	1965	1.8–6.6		La II	Similar to the above except annealed at 600 C for 1·6 hrs; residual electrical resistivity ρ(4.2K) = 1.29 μohm cm; electrical resistivity ratio ρ(293 K)/ρ(4.2 K) = 44.0; specimen in superconducting state below the transition point of 6.04 K (determined magnetically); x-ray analysis showed a trace of h.c.p. phase dispersed in the f.c.c. phase.
5	762	L	1965	1.7–7.0		La II	The above specimen measured in a magnetic field of 6600 gauss; specimen in normal conducting state; Lorenz number, L_0 = 2.83 x 10^{-8} V^2 K^{-2}.
6	811		1954	301.2	10		No details given.
7	256	C	1966	291	± 6		< 0.01 rare earth metals, ~ 0.02 base metals; polycrystalline specimen 1 cm in dia and 1.2 cm long; electrical resistivity 61 μohm cm at 291 K; data point derived by the authors from measurements by 2 different thermal comparators.
8	932, 933	L	1966	83–450	± 3 to ± 5	La 1	0.1 O, 0.01 Ce, 0.003 Fe, 0.005 Cu, 0.005 Nd, and 0.005 Pr; hexagonal polycrystalline; electron-beam refined; electrical resistivity reported as 28.5, 37.3, 46.6, 53.9, 60.6, 66.1, 69.4, and 73.1 μohm cm at 98, 151, 199, 251, 300, 351, 397, and 447 K, respectively; measured in a vacuum of 10^{-4}~10^{-5} mm Hg.

DATA TABLE NO. 25 THERMAL CONDUCTIVITY OF LANTHANUM

(Impurity <0.20% each; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

CURVE 1

T	k
2.18	0.00194
3.09	0.00306
4.56	0.00583
5.65	0.00850
7.89	0.0133
9.82	0.0170
11.6	0.0200
14.7	0.0254
17.5	0.0293
21.4	0.0350
22.1	0.0368
24.7	0.0378
29.6	0.0435
32.0	0.0485
35.5	0.0526

CURVE 2

T	k
1.80	0.0050
1.90	0.0065
2.00	0.0080
2.15	0.0100
2.30	0.0120
2.50	0.0150
2.80	0.0200
2.90	0.0230
3.00	0.0250
3.05	0.0260
3.40	0.0310
3.50	0.0340
3.75	0.0400
3.85	0.0425
4.15	0.0490
4.30	0.0515
4.50	0.0565
4.70	0.0615*
4.75	0.0620*
4.80	0.0640
4.90	0.0660*
5.00	0.0680
5.05	0.0705*
5.15	0.0730

CURVE 2 (cont.)

T	k
5.30	0.0755*
5.40	0.0785*
5.55	0.0810*
5.70	0.0840
5.80	0.0850*
6.00	0.0880
6.20	0.0920
6.55	0.0930

CURVE 3

T	k
1.70	0.0310
1.90	0.0330
2.10	0.0350
2.30	0.0375
2.40	0.0400
2.60	0.0435
2.70	0.0465
3.25	0.0540
3.40	0.0540
3.55	0.0580
3.80	0.0605
3.90	0.0640
4.20	0.0685
4.40	0.0720
4.60	0.0745
4.80	0.0760
4.90	0.0790
5.10	0.0790
5.20	0.0810*
5.30	0.0820
5.50	0.0840*
5.60	0.0845*
6.00	0.0885*
6.10	0.0900*
6.30	0.0920*
6.60	0.0940*
6.70	0.0955

CURVE 4

T	k
1.80	0.0070
2.00	0.0100
2.15	0.0130
2.20	0.0140
2.35	0.0170
2.50	0.0215
2.60	0.0240
2.75	0.0290
3.00	0.0320
3.10	0.0360
3.35	0.0410
3.60	0.0515
3.75	0.0580
4.00	0.0625
4.40	0.0790
4.60	0.0850
4.60	0.0875
4.70	0.0880*
4.90	0.0950
5.15	0.1040
5.40	0.1090
5.55	0.1110*
5.70	0.1165
5.80	0.1170*
6.00	0.1210
6.60	0.1305

CURVE 5

T	k
1.70	0.0420
1.90	0.0445
2.05	0.0455
2.10	0.0475
2.40	0.0540
2.60	0.0570
2.80	0.0615
2.95	0.0660
3.10	0.0650
3.30	0.0765
3.90	0.0655
4.60	0.0970
4.75	0.1030

CURVE 5 (cont.)

T	k
5.10	0.1090
5.35	0.1110
5.60	0.1170
5.80	0.1205
6.15	0.1245
6.35	0.1265
6.70	0.1310*
6.95	0.1310

CURVE 6

T	k
301.2	0.138

CURVE 7

T	k
291.0	0.140

CURVE 8

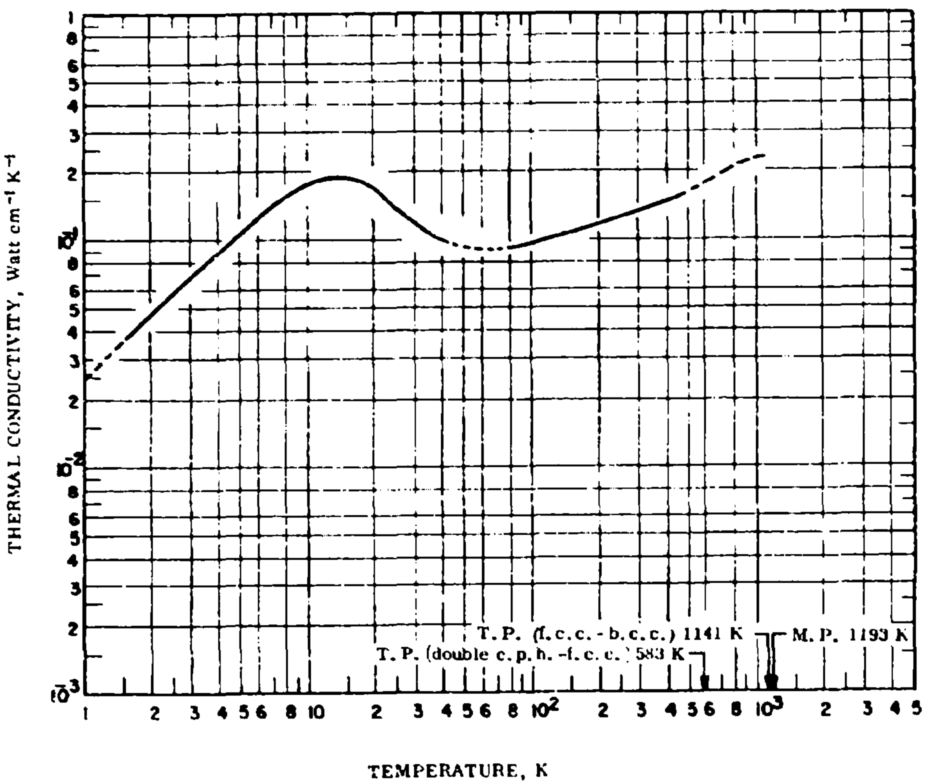
T	k
83	0.0904
88	0.0879
96	0.0925
103	0.0900
114	0.0975
116	0.0933
135	0.100
145	0.0983
154	0.104
195	0.115
201	0.116
207	0.115
218	0.114
234	0.117
296	0.123
301	0.128
305	0.127
309	0.129
312	0.129*
320	0.131*
321	0.128
337	0.132*
341	0.133

CURVE 8 (cont.)

T	k
359	0.136
373	0.133
377	0.138
378	0.134*
381	0.138*
382	0.135
389	0.139
393	0.141*
398	0.141
401	0.144
439	0.145
442	0.144*
443	0.147*
446	0.144
450	0.148

* Not shown on Plot

FIGURE AND TABLE NO. 25R RECOMMENDED THERMAL CONDUCTIVITY OF LANTHANUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	(0.162)	(9.36)	440.3
1	(0.0250)‡	(1.44)	-457.9	600	(0.178)	(10.3)	620.3
2	0.0468	2.70	-456.1	700	(0.196)	(11.3)	800.3
3	0.0674	3.89	-454.3	800	(0.211)	(12.2)	980.3
4	0.0875	5.06	-452.5	900	(0.222)	(12.8)	1160
5	0.107	6.18	-450.7	1000	(0.229)	(13.2)	1340
6	0.124	7.16	-448.9	1100	(0.232)	(13.4)	1520
7	0.140	8.09	-447.1				
8	0.154	8.90	-445.3				
9	0.166	9.59	-443.5				
10	0.176	10.2	-441.7				
11	0.183	10.6	-439.9				
12	0.188	10.9	-438.1				
13	0.191	11.0	-436.3				
14	0.192	11.1	-434.5				
15	0.191	11.0	-432.7				
16	0.188	10.9	-430.9				
18	0.179	10.3	-427.3				
20	0.168	9.71	-423.7				
25	0.141	8.15	-414.7				
30	0.121	6.99	-405.7				
35	0.108	6.24	-396.7				
40	(0.101)	(5.84)	-387.7				
45	(0.0969)	(5.60)	-378.7				
50	(0.0943)	(5.45)	-369.7				
60	(0.0927)	(5.36)	-351.7				
70	(0.0929)	(5.37)	-333.7				
80	(0.0941)	(5.44)	-315.7				
90	0.0958	5.54	-297.7				
100	0.0978	5.65	-279.7				
150	0.109	6.30	-189.7				
200	0.118	6.82	- 99.7				
250	0.127	7.34	- 9.7				
273.2	0.131	7.57	32.0				
300	0.135	7.80	80.3				
350	0.142	8.20	170.3				
400	0.149	8.61	260.3				

REMARKS

The recommended values are for well-annealed 99.99+% pure lanthanum with residual electrical resistivity $\rho_0 = 1.29\ \mu\Omega$ cm (characterization by ρ_0 becomes important below about 150 K). The values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}. ‡Values in parentheses are extrapolated, interpolated, or estimated.

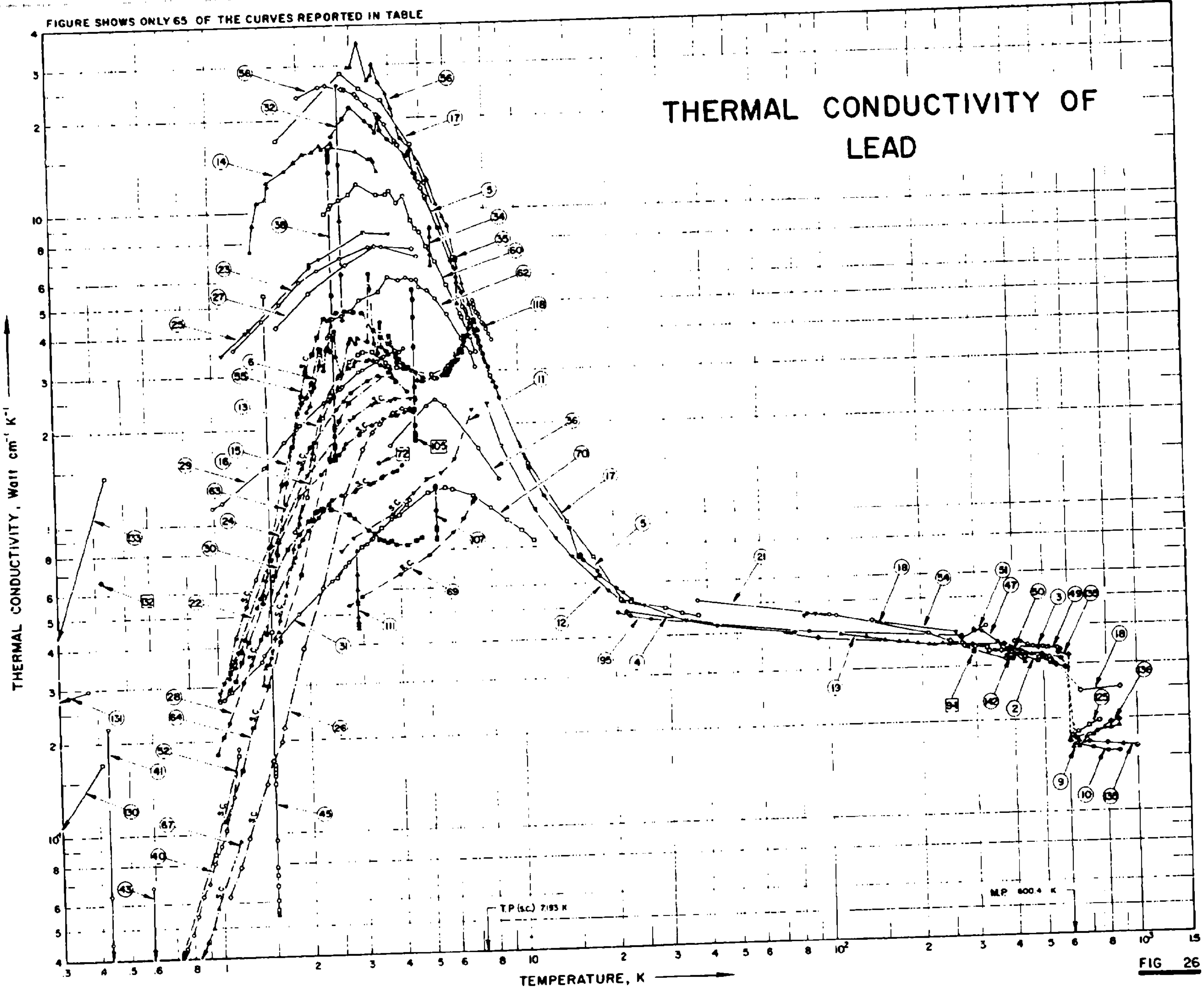


FIGURE SHOWS ONLY 65 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF LEAD
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P (s.c) 7.193 K
M.P. 600.4 K

FIG 26

SPECIFICATION TABLE NO. 26 THERMAL CONDUCTIVITY OF LEAD

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 26]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	48	C	1954	326-497			Specimen of 1 in. cube; cut and machined from a bar of melting-point lead supplied by NBS (sample No. 49 C); all surfaces carefully lapped; nickel used as comparative material.
2	129, 852	C	1933	273-530	3	L.S.	Bureau of Standard melting point standard lead; purity indicated by freezing point of 327.4 C; specimen 15 cm long, 2 cm in dia; melted in graphite and cast in bottom feed cast iron mold; all data referred to the value 0.352 Watt $cm^{-1}K^{-1}$ at 0 C taken from International Critical Tables, Volume II, p. 218.
3	84	P	1918	363-483			Pure, "squirted" wire, 3.1 mm in dia; thermal conductivity values calculated from measured data of thermal diffusivity and the specific heat values taken from literature.
4	95	E	1915	22-374			99.998 pure; specimen 6.24 cm long, 0.2996 cm in dia; electrical resistivity reported as 19.26 and 20.69 μohm cm at 0 and 18 C, respectively.
5	63	L	1940	2.6-23			Single crystal, pure lead obtained from Adam Hilger Ltd. (H.S. brand); melted in high vacuum; filtered through a narrow glass opening, pressed in nitrogen into a glass tube of the desired shape then cooled slowly to make a specimen of 15 cm long, 2.5 mm in dia; transition point ~7.13 K; thermal conductivity data in normal state below transition point obtained by applying a transversal magnetic field of strength 472-810 gauss.
6	63	L	1940	2.0-7.1			The above specimen in superconducting state.
7	77	E	1900	291,273			99.95 Pb (by difference), < 0.05 total Cu, Bi, Fe, and Ni; 1.8028 cm dia x 27.0 cm long; density 11.32 g cm^{-3} at 18 C; electrical conductivity reported as 4.84 and 3.64×10^4 $ohm^{-1}cm^{-1}$ at 18 and 100 C, respectively.
8	77	L	1900	291,273			Similar to the above specimen.
9	113	C	1957	623-873		Lab No. 5873	99.995+ pure, molten specimen contained in a thin-walled tube; electrical resistivity reported as 95.0, 97.2, 99.5, 102.0, 104.4, and 106.8 μohm cm at 350, 400, 450, 500, 550, and 600 C, respectively. 0.8% carbon steel used as comparative material.
10	85	L	1919	381-871			Cylindrical specimen.
11	18	L	1936	2.6-7.1			In superconducting state.
12	18	L	1936	7.9-77			No details reported.
13	117	L	1949	1.4-3.8		Pb II	High purity; single crystal; specimen 3.8 mm in dia obtained from Adam Hilger Ltd. (H.S. brand); in superconducting state.
14	117	L	1949	1.4-3.9		Pb II	The above specimen in normal state; measured in a longitudinal magnetic field of 850 oersteds.
15	117	L	1949	1.4-2.5		Pb III	Similar to the above specimen but 4.0 mm in dia; in superconducting state.

SPECIFICATION TABLE NO. 26 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
16	97	L	1952	1.8-6.7	± 3	Pb I	99.998 pure; Tadanac lead; single crystal; in superconducting state.
17	97	L	1952	1.7-38	± 3	Pb I	The above specimen in normal state.
18	14	L	1940	136-887			No details reported.
19	88	L	1908	109-299			Turned from a bar of pure lead supplied by Messr. Baxendale, Manchester; density 11.29 g cm^{-3} at 25 C; electrical resistivity reported as 6.71, 9.71, 12.9, 15.7, 18.5, and 20.9 μ ohm cm at -170, -129.4, -89.2, -51.8, -14.0, and 17.4 C, respectively.
20	144	L	1952	317.2			Specimen cut from melting point standard lead supplied by NBS; 1.75 x 0.1875 x 0.1875 in.; measured in vacuo.
21	16	F	1929	37-378			No details reported.
22	257, 379	L	1958	1.1-4.6	± 2	Pb 1	99.99 pure; monocrystal; obtained from Johnson & Matthey Co. Ltd. (No. 560); specimen ~7 cm long, 3 mm in dia; annealed in vacuo for several days at a few degrees below the melting point; residual electrical resistivity 0.008 μohm cm; in superconducting state.
23	257, 379	L	1958	1.2-4.8	± 2	Pb 1	The above specimen in normal state; measured in a transversal magnetic field of 1000 gauss.
24	257	L	1958	1.0-4.6	± 2	Pb 2	99.99 pure; polycrystal; obtained from Johnson and Matthey Co. Ltd. (No. 560); grain size 0.5 mm; specimen ~7 cm long, 3 mm in dia; annealed in vacuo for several hrs at a few degrees below the melting point; residual electrical resistivity 0.008 μ ohm cm; in superconducting state.
25	257	L	1958	1.1-3.9	± 2	Pb 2	The above specimen in normal state; measured in a transversal magnetic field of 1000 gauss.
26	257	L	1958	1.1-4.6	± 2	Scroll	Pure; hollow cylindrical specimen 3 cm in dia made from lead foil 0.070 mm thick; annealed in vacuo for 5 days at a few degrees below the melting point; in superconducting state.
27	257	L	1958	1.6-4.6	± 2	Scroll	The above specimen in normal state; measured in a magnetic field of 1000 gauss.
28	257	L	1958	0.98-4.2	± 2	PbBi 0.02	99.98 Pb, 0.02 Bi, polycrystal with long crystals; specimen ~7 cm long, 3 mm in dia, annealed in vacuo for several hrs at a few degrees below the melting point; residual electrical resistivity 0.021 μohm cm; in superconducting state.
29	257	L	1958	0.98-4.3	± 2	PbBi 0.02	The above specimen in normal state; measured in a magnetic field of 1000 gauss.
30	257	L	1958	1.1-4.8	± 2	PbBi 0.1	99.899 Pb (by difference), 0.101 Bi; polycrystal; grain size 0.3 mm; specimen ~7 cm long, 3 mm in dia; annealed in vacuo for several hrs at a few degrees below the melting point; residual electrical resistivity 0.092 μohm cm; in superconducting state.
31	257	L	1958	1.0-4.4		Pb Bi 0.1	The above specimen in normal state; measured in a magnetic field of 1000 gauss.

SPECIFICATION TABLE NO. 26 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
32	342	L	1953	2.7		Pb 1	99.998 pure; single crystal; measured in transverse magnetic fields of strength ranging from 0.70 to 3.90 kilooersteds.
33	342	L	1953	2.7		Pb 1	The above specimen measured in longitudinal magnetic fields of strength ranging from 0.87 to 3.94 kilooersteds.
34	342	L	1953	5.3		Pb 1	The above specimen measured in transverse magnetic fields of strength ranging from 1.86 to 3.94 kilooersteds.
35	342	L	1953	6.4		Pb 1	The above specimen measured in transverse magnetic fields of strength ranging from 0.52 to 3.94 kilooersteds.
36	18	L	1936	3.8-8.6			Measured in a magnetic field of 764 gauss.
37	18	L	1936	6.39			The above specimen measured in a magnetic field of 765 gauss.
38	461	L	1951	2.5			99.998 pure; 0.5 cm dia x 10 cm long, measured in transverse magnetic fields of strength ranging from 0 to 921 gauss.
39	461	L	1951	2.5			The above specimen measured in transverse magnetic fields of decreasing strength ranging from 685 to 0 gauss.
40	462	L	1952	0.40-1.2			Single crystal; in superconducting state.
41	462	L	1952	0.43			The above specimen measured in magnetic fields with increasing strength ranging from 0 to 100% of the critical magnetic field.
42	462	L	1952	0.43			The above specimen measured in magnetic fields with decreasing strength ranging from 82 to 0% of the critical magnetic field.
43	462	L	1952	0.59			The above specimen measured in magnetic fields with increasing strength ranging from 0 to 100% of the critical magnetic field.
44	462	L	1952	0.59			The above specimen measured in magnetic fields with decreasing strength ranging from 72 to 37% of the critical magnetic field.
45	462	L	1952	1.5			The above specimen measured in magnetic fields with increasing strength ranging from 0 to 86% of the critical magnetic field.
46	462	L	1952	1.5			The above specimen measured in magnetic fields with decreasing strength ranging from 69 to 0% of the critical magnetic field.
47	218	E	1956	298-437	± 3		Nominally pure; electrical conductivity reported as 4.4, 4.25, 3.6, 3.05, 2.65, and 2.45 x 10^4 $ohm^{-1}cm^{-1}$ at 37, 50, 100, 150, 200, and 230 C, respectively.
48	406	C	1922	313.2	5		Pure lead specimen 3 cm long and 3 cm in dia; zinc used as a comparative material.
49	131	E	1944	405-570			Pure; single crystal; electrical resistivity reported as 29.67, 34.01, 39.68, 42.01, and 47.16 μohm cm at 405.1, 445.1, 499.1, 521.1, and 570.1 K, respectively.

SPECIFICATION TABLE NO. 28 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
50	431	F	1944	390–540			Pure polycrystal; electrical resistivity reported as 30.1, 38.16, 42.44, and 46.88 μ ohm cm at 390.1, 461.8, 499.0, and 539.9 K, respectively.
51	463	E	1924	273–326			Pure (supposed to be Kahlbaum's); 25 cm long, cross sectional area 0.439 cm².
52	682	L	1960	0.16–1.2		I	99.999 pure; single crystal, specimen 0.13 cm in dia ~5.0 cm long; in superconducting state.
53	464	R	1917	285–310	1.2		Commercially pure (major impurity probably tin); specimen composed of 2 hollow hemispheres of 3.65 cm internal radius and 7 cm external radius.
54	465	C	1907	83–300			Pure specimen (Kahlbaum lead) 32.85 mm in dia and 7 cm long; copper used as comparative material.
55	466	L	1961	1.4–7.3		E	99.9+ Pb (by difference), < 0.1 metallic impurities; single crystal;enriched in isotopes of lead; specimen 1.54 cm long, 0.186 cm in dia; cast in high vacuum (10^{-5} mm Hg); annealed in vacuum for 5 hrs at 260 C; in superconducting state.
56	466	L	1961	2.9–7.3		E	The above specimen measured in a longitudinal magnetic field at 900 gauss; in normal state.
57	466	L	1961	1.5–7.7		D	99.95 Fe (by difference), 0.05 metallic impurities; specimen 2.40 cm long, 0.123 cm in dia; same fabrication method as the above specimen; in superconducting state.
58	466	L	1961	2.0–7.6		D	The above specimen measured in a longitudinal magnetic field of 900 gauss; in normal state.
59	466	L	1961	2.4–7.6		B	Similar to the above specimen but 2.26 cm long and 0.123 cm in dia; in superconducting state.
60	466	L	1961	2.4–7.3		B	The above specimen measured in a longitudinal magnetic field of 900 gauss; in normal state.
61	466	L	1961	2.4–7.7		C	Similar to the above specimen but 2.05 cm long and 0.123 cm in dia; in superconducting state.
62	466	L	1961	2.4–7.3		C	The above specimen measured in a longitudinal magnetic field of 900 gauss; in normal state.
63	389, 676	L	1958	1.0–4.4			99.99 pure; single crystal; straight wire; annealed at 270 C for 3 days; in superconducting state.
64	389, 676	L	1958	1.0–4.0			The above specimen bent at 4.2 K and annealed at 90 K; in superconducting state.
65	389, 676	L	1958	1.1–4.4			The above specimen annealed at 290 K; in superconducting state.
66	467	C	1953	313–429	± 5	55 NI - 1	NBS melting point standard lead; inconel used as comparative material.
67	412	L	1955	0.41–1.2	± 5		99.998 pure Tadanac lead; single crystal; measured without magnetic Shielding; in superconducting state.

SPECIFICATION TABLE NO. 26 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
68	412	L	1955	0.30-0.87	± 5		The above specimen measured with magnetic shielding; in superconducting state.
69	508, 468	L	1950	2.7-7.2			99.98 Pb (by difference), 0.02 Bi; in superconducting state.
70	508, 468	L	1950	2.5-11			The above specimen in normal state; measured in a magnetic field.
71	230	L	1925	327.2			Baker's analyzed metal: total impurities < 0.03; rod 1.9 cm in dia and 10 cm long; electrical conductivity 4.76 $ohm^{-1}cm^{-1}$ at 22 C.
72	18	L	1936	3.47			Measured in a magnetic field of 1006 gauss.
73	18	L	1936	4.4, 4.6			The above specimen measured in a magnetic field of 956 gauss.
74	506	C	1953	322-414		55 M - 1	NBS melt point standard lead; specimen 0.350 in. in dia and 0.510 in. long; copper used as the comparative material.
75	506	C	1953	319-419		55 P - 1	Similar to the above specimen but 0.450 in. in dia and 0.509 in. long.
76	506	C	1953	319-385		55 J - 1	Similar to the above specimen but 0.250 in. in dia and 0.265 in. long.
77	506	C	1953	321-416		55 K - 1	Similar to the above specimen but 0.250 in. in dia and 0.528 in. long.
78	506	C	1953	316-398		55 L - 1	Similar to the above specimen but 0.300 in. in dia and 0.502 in. long.
79	506	C	1953	319-400		55 N - 1	Similar to the above specimen but 0.410 in. in dia and 0.489 in. long.
80	506	C	1953	316-436		55 N - 2	Similar to the above specimen but 0.410 in. in dia and 0.487 in. long.
81	506	C	1953	322-401		55 Q - 1	Similar to the above specimen but 0.500 in. in dia and 0.500 in. long.
82	506	C	1953	314-405		55 Q - 2	Similar to the above specimen but 0.500 in. in dia and 0.476 in. long.
83	96, 468	L	1950	2.6-9.4			99.9 Pb, 0.1 Bi; in normal state; measured in a magnetic field.
84	96, 468	L	1950	2.7-6.4			The above specimen in superconducting state.
85	509	C	1954	314-381	± 3	55 B - 1	Accurately ground specimen 0.500 ± 0.001 in. in dia and 0.500 ± 0.005 in. long; electrolytic deposited pure copper used as a comparative material; reference data of copper taken from International Critical Tables, Vol. 5, McGraw-Hill, p. 221, 1929.
86	509	C	1954	324-401	± 3	55 B - 2	Second run of the above specimen.
87	509	C	1954	314-414	± 3	55 B - 3	Third run of the above specimen.
88	735, 839	P	1955	850-1250	6-8		Molten specimen in a tantalum crucible made from 2 coaxial tubes with dia of 23.8 and 8 mm, each tube 0.12 mm thick; data calculated from measured data of thermal diffusivity and specific heat, and values of density taken from Slavinskii, M.P. [Physicochemical Properties of elements (in Russian), 1952].
89	510	L	1956	373-473		H	99.997+ pure electrolytic lead; specimen 20 mm in dia and 40 mm long.
90	510	L	1956	328-523		B	Similar to the above specimen.

SPECIFICATION TABLE NO. 26 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
91	510	L	1956	328-523		P	Rectangular specimen of the same purity as the above specimen; size 22 x 22 x 40 mm.
92	510	L	1556	380-510		A	Similar to the above specimen but 20 mm in dia and 50 mm long.
93	510	L	1956	373-473		L	Similar to the above specimen but only 40 mm long.
94	511	L	1918	298.0			Specimen radius 0.675 cm; furnished by "Erba".
95	619	L	1916	20-273			Lead (technical) specimen 0.5 cm in dia and 5 cm long; electrical conductivity reported as 173.57 and 5.09×10^4 $ohm^{-1}cm^{-1}$ at 20.4 and 273 K, respectively.
96	619	L	1916	21-273			Pure Kahlbaum lead specimen 0.5 cm in dia and 5 cm long.
97	592	L	1959	700-1130			In liquid state; melting point 327.4 C; measured in a vacuum of 5×10^{-4} mm Hg.
98	702	E	1961	293-347	1		99.99 pure; size 0.184 x 2 x 6 in.; specimen cut from a prefabricated sheet.
99	703	C	1955	319-411			NBS melting point standard lead; data obtained by using 28 gauge iron-constantan thermocouples with OFHC copper used as comparative material.
100	703	C	1955	328-405			The above specimen measured by using 30 gauge copper-constantan thermocouples.
101	703	C	1955	317-376			The above specimen measured by using 24 gauge copper-constantan thermocouples.
102	706	L	1881	273, 373			23.7 cm long; electrical conductivity reported as 5.141 and 3.602×10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively. (The author reported as 5.141 and 3.602×10^5 $ohm^{-1}cm^{-1}$, obviously a typographical error.)
103	237	L	1950	2.7			99.998 pure (by difference), impurity < 0.002; cylindrical specimen prepared from Johnson Matthey H.S. lead; measured in longitudinal magnetic fields of increasing strength ranging from 0 to 1000 gauss.
104	237	L	1950	2.7			The above specimen measured in magnetic fields of decreasing strength ranging from 1000 to 0 gauss.
105	237	L	1950	4.6			The above specimen measured in magnetic fields of increasing strength ranging from 0 to 1000 gauss.
106	237	L	1950	4.6			The above specimen measured in magnetic fields of decreasing strength ranging from 610 to 33 gauss.
107	237	L	1950	5.29			About 99.98 Pb (by difference), 0.02 Bi; cylindrical specimen prepared from Johnson Matthey H.S. lead (impurity <0.002%); measured in longitudinal magnetic fields of increasing strength 0 to 1000 gauss.
108	237	L	1950	5.29			The above specimen measured in longitudinal magnetic fields of decreasing strength ranging from 1000 to 45 gauss.
109	237	L	1950	5.40			The above specimen measured in transverse magnetic fields of increasing strength ranging from 0 to 1000 gauss.

SPECIFICATION TABLE NO. 26 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
110	237	L	1950	5.40			The above specimen measured in transverse magnetic fields of decreasing strength ranging from 996 to 0 gauss.
111	237	L	1950	2.89			The above specimen measured in transverse magnetic fields of increasing strength ranging from 0 to 1000 gauss.
112	237	L	1950	2.89			The above specimen measured in transverse magnetic fields of decreasing strength ranging from 1000 to 0 gauss.
113	237	L	1950	2.92			The above specimen measured in longitudinal magnetic fields of increasing strength ranging from 0 to 1000 gauss.
114	237	L	1950	2.92			The above specimen measured in longitudinal magnetic fields of decreasing strength ranging from 1000 to 0 gauss.
115	237	L	1950	2.6-21			The above specimen measured in a magnetic field greater than the critical field; in normal state.
116	237	L	1950	2.8-7.2			The above specimen measured before applying the magnetic field; in superconducting state.
117	237	L	1950	2.7-3.9			The above specimen measured after applying the magnetic field; in superconducting state.
118	693, 729	L	1963	7.2-8.3			Lead specimen grade 69 of the Consolidated Mining and Smelting Co.; single crystal; 0.25 in. in dia and 3 in. long; zone refined.
119	693, 729	L	1963	6.4-8.3			The above specimen measured in a magnetic field of 600 gauss; in normal state; data corrected to zero field.
120	693, 729	L	1963	6.3-8.3			The above specimen measured in a magnetic field of 680 gauss; in normal state; data corrected to zero field.
121	693, 729	L	1963	6.2-7.3			The above specimen measured in a magnetic field at 800 gauss; in normal state; data corrected to zero field.
122	693, 729	L	1963	5.5-7.2			The above specimen in superconducting state.
123	730	L	1945	291-333	> 2	NBS sample 49b	Calibration specimen for freezing point determination.
124	730	L	1945	302-330	> 2	NBS sample 49b	The above specimen remeasured with a slightly different method of balancing thermocouples to avoid radial heat losses.
125	707	C	1953	617-755			0.10 Foreign non-volatile matter, < 0.001 Ag, and < 0.001 other foreign metals; in molten state; produced by Mallinckrodt Chemical Works; test cylinder 3 in. in dia; Armco iron used as comparative material; data taken from smoothed curve, corrected for the effect of transients.

SPECIFICATION TABLE NO. 26 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
126	731	L	1952	0.13-0.29			99.998+ pure; provided by Johnson Matthey & Co. Ltd., London, (Batch No. 3620); specimen size 8 x 2.1 x 25 mm; warm up number 1; in superconducting state.
127	731	L	1952	0.18-0.36			The above specimen, warm up number 2.
128	731	L	1952	0.19-0.38			The above specimen, warm up number 3.
129	732	L	1965	0.015-0.23			99.999 pure (nominal); supplied by Koch-Light Laboratories Ltd. (Colnbrook, England); wire 5 cm long and 0.5 mm in dia; measured in a longitudinal magnetic field of 1000 gauss; in normal state.
130	733	L	1962	0.11-0.41			99.999 pure; polycrystalline; material obtained from Central Research Laboratories, American Smelting and Refining Co.; ratio of specimen cross sectional area to length 3.47×10^{-3} cm; cut and rolled from a lead bar of the mentioned purity; annealed at room temperature for many weeks; measured in a longitudinal magnetic field of 900 gauss; in normal state.
131	733	L	1962	0.20-0.33			The above specimen measured in a transverse magnetic field of 3000 gauss.
132	733	L	1962	0.42			The above specimen measured in a transverse magnetic field of 2000 gauss.
133	733	L	1962	0.14-0.41			The above specimen measured in a transverse magnetic field of 1000 gauss.
134	734	R	1926	323.2			Specimen in the form of a long hollow cylinder.
135	744	P	1966	560-1355	7-8		Molten lead filled the space between two coaxial thin-walled tubes of tantalum of 24 and 8 mm dia, respectively; thermal conductivity values calculated from measured data of thermal diffusivity and specific heat.
136	838	C	1967	474-870			Molten specimen placed in a hole 21 mm in dia drilled in an asbestos cement cylinder 30 mm in height; 1Kh18N9T steel used as comparative material.
137	840	L	1966	223-573	< 1		Lead specimen cut from bar of 99.999 pure or better; supplied by Dept. of Mines and Technical Surveys, Ottawa; smoothed values (experimental point deviations less than 1.5%).
138	840	L	1966	223-573	< 1		Lead specimen cut from the same bar as above and measured by another apparatus with modifications of the thermal shielding.
139	841	L	1967	335-602	13		99.995+ Pb, 0.001 Cd, 0.0005 Ag, 0.0005 Cu, and 0.0003 Bi; 7 mm dia x 15 cm long; supplied by Johnson Matthey & Co.; electrical resistivity reported as 19.3, 23.4, 27.5, 31.8, 36.3, 40.8, and 45.7 μohm at 0, 50, 100, 150, 200, 250, and 300 C, respectively.
140	842	C	1967	316-420		Pyrometric standard lead 49 c	0.03 Bi, 0.002 Ag, 0.002 Cd, 0.001 Fe, 0.001 Ni, 0.001 Si, 0.001 Te, 0.0005 Cu, 0.0005 Sn, and 0.0001 Mg; electrical resistivity reported as 0.394, 0.735, 4.84, and 21.31 μohm cm at 20, 25, 77, and 298 K, respectively; M.P. 327.3 C; Armco iron used as comparative material.

SPECIFICATION TABLE NO. 26 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
141	842	C	1967	323-434		Pyrometric standard lead 49 e	0.001 Fe, 0.001 Ni, 0.001 Si, < 0.001 Te, 0.0005 Ag, 0.0005 Bi, 0.0005 Cu, < 0.0005 Cd, < 0.0005 Sn, and 0.0001 Mg; electrical resistivity reported as 0.366, 0.685, 4.83, and 21.25 μ ohm cm at 20, 25, 77, and 298 K, respectively; M.P. 327.417 C; Armco iron used as comparative material.
142	870	L	1949	338-399			No details reported.

DATA TABLE NO. 26 THERMAL CONDUCTIVITY OF LEAD

(Impurity <0.20% each; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1*	
325.7	0.342
325.9	0.347
326.2	0.351
328.2	0.348
328.2	0.342
347.2	0.347
347.7	0.341
358.2	0.347
358.2	0.342
364.2	0.342
365.2	0.339
381.7	0.339
383.2	0.342
394.7	0.338
395.2	0.336
404.2	0.335
404.2	0.332
413.2	0.336
413.2	0.332
427.8	0.331
428.2	0.332
438.7	0.331
439.2	0.326
445.7	0.329
446.2	0.327
455.7	0.330
456.0	0.323
464.2	0.322
465.2	0.326
476.2	0.323
477.2	0.322
490.2	0.322
490.7	0.323
496.2	0.318
497.2	0.314
CURVE 2	
273.2	0.352
329.2	0.3412
333.2	0.3399
395.2	0.3278
436.2	0.3170
439.2	0.3219*
481.2	0.3060
483.2	0.3140
526.2	0.3070
530.2	0.3037
CURVE 3	
363.2	0.346
365.2	0.345*
483.2	0.337
483.2	0.340
CURVE 4	
21.8	0.480
91.7	0.378
273.1	0.350*
295.1	0.349
373.8	0.349
CURVE 5	
2.58	17.5
2.81	20.0
2.97	21.7
3.33	19.6
3.49	18.9
3.59	17.9
3.67	20.0
3.71	18.2
3.94	16.9
4.55	14.9
4.60	15.4
4.75	13.3
4.81	12.7
CURVE 5 (cont.)	
4.84	13.2*
4.85	13.3
5.19	10.9
5.67	8.70
6.19	6.76
6.68	5.35
7.15	4.22
7.17	4.22*
7.17	4.13*
7.31	4.07*
7.42	3.85*
7.43	3.83
7.52	3.75
7.63	3.56
7.76	3.38
8.01	3.06
8.05	3.06*
8.32	2.75
8.43	2.65
8.69	2.43
10.74	1.45
11.98	1.16
14.38	0.913
15.47	0.730
15.57	0.746
15.85	0.714
17.63	0.658
17.92	0.633
20.19	0.575
21.31	0.552
22.70	0.526
CURVE 6	
2.04	2.25
2.10	2.36
2.13	2.65
2.17	2.73
2.26	3.19
2.29	3.60
2.36	3.09
CURVE 6 (cont.)	
2.38	3.57
2.42	3.64
2.54	4.10
2.56	3.39
2.67	2.99
2.83	3.75
2.87	3.88
2.96	3.72
3.09	3.88
3.26	3.77
3.34	6.21
3.35	5.59
3.44	3.72
3.53	3.46
3.60	4.37
3.61	3.61
3.73	3.52
3.80	3.42
3.82	3.94
4.03	3.34
4.05	3.23
4.25	3.19
4.63	3.08
4.63	2.99
4.73	2.82
4.88	2.79
5.22	2.82*
5.25	2.85
5.28	2.87*
5.68	2.91
5.80	2.99
5.92	2.99
6.02	3.05
6.12	3.12
6.14	3.15
6.14	3.16*
6.24	3.23
6.41	3.38*
6.44	3.40*
6.51	3.47*
6.76	3.70
6.96	4.10
7.06	4.26
CURVE 7*	
291.2	0.346
373.2	0.341
CURVE 8*	
291.2	0.343
373.2	0.339
CURVE 9	
623.2	0.160
627.2	0.164
647.2	0.167
648.2	0.159
673.2	0.166
683.2	0.173
718.2	0.175
783.2	0.185
823.2	0.184
873.2	0.187
CURVE 10	
381.2	0.335
495.2	0.322
571.2	0.310
599.2	0.289
628.2	0.163*
720.2	0.159
804.2	0.155
874.2	0.155
CURVE 11	
2.59	0.800
2.83	0.885
3.84	1.053
4.49	1.220
4.96	1.351
5.51	1.408
6.14	1.563
7.09	2.222
CURVE 12	
7.90	2.326
8.77	1.695
11.10	1.053
13.00	0.847
14.60	0.735
17.30	0.621
19.10	0.565
21.00	0.524
25.00	0.500
34.00	0.442
43.00	0.426
77.00	0.397
CURVE 13	
1.40	0.300
1.42	0.340
1.44	0.350
1.47	0.350
1.49	0.370
1.54	0.427
1.58	0.446
1.60	0.485
1.68	0.581
1.70	0.641
1.79	0.746
1.80	0.826
1.89	0.990
1.90	1.05
2.10	1.61
2.12	1.68
2.24	2.13
2.27	2.16
2.37	2.46
2.44	2.61
2.58	2.92
2.61	2.96
2.81	3.12
2.93	3.17
2.96	3.27
3.22	3.27
3.29	3.31
3.40	3.27
CURVE 13 (cont.)	
3.59	3.17
3.74	3.13
3.75	3.13
3.84	3.10
CURVE 14	
1.37	7.50
1.40	9.10
1.45	10.80
1.55	11.00
1.66	12.60
1.67	12.20
1.79	13.70
1.93	14.50
2.06	15.40
2.21	15.60
2.35	16.40
2.39	15.90
2.56	16.70
2.58	16.10
3.09	15.60
3.41	14.70
3.47	14.70
3.52	14.50
3.88	13.50
CURVE 15	
1.41	0.55
1.52	0.85
1.67	1.33
1.81	1.76
1.96	2.43
2.03	2.54
2.12	2.82
2.27	3.60
2.46	3.54
CURVE 16	
1.82	0.937
2.01	1.201
2.30	2.152
2.84	3.274
3.04	3.459
3.14	3.498
3.38	3.485
3.72	3.228
4.04	3.102
4.67	2.997
5.23	2.924
5.97	3.102
6.34	3.380
6.73	3.868
CURVE 17	
1.69	10.710
2.78	28.225
3.20	25.000
3.76	22.820
4.65	16.285
5.14	12.270
6.28	6.967
6.71	4.818
6.96	4.422
7.16	4.196
8.18	2.865
10.71	1.492
14.10	0.951
17.16	0.731
21.06	0.527
22.51	0.516
29.28	0.491
33.06	0.470
37.50	0.461
CURVE 18	
138.0	0.427
245.0	0.361
301.4	0.345
366.2	0.333

* Not shown on plot

DATA TABLE NO. 26 (continued)

T	k
CURVE 18 (cont.)	
523.9	0.314
659.2	0.244
887.2	0.249
CURVE 19	
109.2	0.387
132.2	0.377
152.2	0.369
169.2	0.363
181.2	0.362
195.2	0.357
212.2	0.354
221.2	0.352
236.2	0.356
248.2	0.352
256.2	0.353
272.2	0.352*
284.2	0.348
292.2	0.349*
296.2	0.346*
299.2	0.346*
CURVE 20*	
371.2	0.337
CURVE 21	
37.2	0.516
100.2	0.450
106.2	0.448
213.5	0.354
276.3	0.348
377.8	0.314
CURVE 22	
1.07	0.316
1.09	0.331
1.09	0.333
1.13	0.345
1.16	0.385
1.19	0.386
1.19	0.390
1.22	0.421

T	k
CURVE 22 (cont.)	
1.35	0.532
1.38	0.571
1.42	0.587
1.45	0.652
1.63	0.87
1.90	1.21
2.24	1.43
2.44	1.59
2.58	1.65
2.69	1.72
2.72	1.78
3.00	1.89
3.33	2.02
3.63	2.13
4.01	2.17
4.26	2.22
4.45	2.25
4.55	2.22
4.58	2.25
4.58	2.27
CURVE 23	
1.18	3.62
1.47	4.49
1.67	5.05
1.96	5.90
2.25	6.43
2.68	7.08
3.32	7.69
3.67	7.64
4.78	7.09
CURVE 24	
1.00	0.285
1.04	0.309
1.12	0.363
1.50	0.765
1.65	0.96
2.03	1.42
2.81	2.10
2.90	2.16
3.32	2.36
3.83	2.42
3.98	2.46
4.46	2.46

T	k
CURVE 24 (cont.)	
4.47	2.46*
4.59	2.48
CURVE 25	
1.07	3.47
1.30	4.12
1.34	4.20
2.13	6.60
2.13	6.75
2.29	7.00
3.23	8.50
3.88	8.40
CURVE 26	
1.05	0.063
1.14	0.078
1.14	0.078*
1.23	0.0965
1.23	0.097*
1.41	0.145
1.48	0.171
1.61	0.219
1.90	0.394
2.21	0.615
2.68	1.22
3.07	1.70
3.32	1.91
3.51	2.04
3.85	2.21
4.18	2.29
4.42	2.27
4.42	2.27*
4.59	2.22*
CURVE 27	
1.64	4.23
2.10	5.44
2.79	6.67
3.49	7.57
4.61	7.45
CURVE 28	
0.98	0.180

T	k
CURVE 28 (cont.)	
1.03	0.206
1.07	0.230
1.21	0.307
1.28	0.352
1.39	0.422
1.59	0.593
1.81	0.775
1.89	0.845
1.94	0.883
2.01	0.945
2.19	1.04
2.26	1.09
2.38	1.14
2.44	1.17
2.64	1.21
2.70	1.22*
2.90	1.25
2.93	1.27
3.25	1.31
3.31	1.33
3.55	1.38
3.59	1.40
3.86	1.44
3.91	1.45
4.00	1.46
4.16	1.51
CURVE 29	
0.98	1.13
1.06	1.17
1.46	1.51
1.71	1.81
1.89	2.00
1.94	2.05
2.33	2.41
2.40	2.49
2.61	2.69
2.67	2.71
3.04	3.01
3.13	3.07
3.42	3.29
3.49	3.29*
3.60	3.34
3.66	3.37
3.91	3.52
3.97	3.52*

T	k
CURVE 29 (cont.)	
4.12	3.48
4.27	3.57
CURVE 30	
1.08	0.292
1.13	0.313
1.18	0.359
1.26	0.416
1.55	0.676
1.72	0.825
1.87	0.916
2.01	1.012
2.15	1.08
2.16	1.09
2.26	1.09
2.28	1.06*
2.40	1.10
2.75	1.06
2.86	1.02
3.18	0.931
3.30	0.910
3.45	0.870
3.58	0.866
3.67	0.847
3.76	0.854
3.90	0.835
4.24	0.831
4.54	0.855
4.76	0.876
CURVE 31	
1.00	0.269
1.04	0.272
1.07	0.287
1.10	0.288
1.38	0.338
1.41	0.375
1.85	0.509
2.38	0.644
2.65	0.716
2.72	0.740
3.14	0.847
3.26	0.876
3.28	0.880
3.79	1.01

T	k
CURVE 31 (cont.)	
4.27	1.12
4.36	1.16
H (kilooersteds)	**k**
CURVE 32 (T = 2.7)	
0.70	25.7
0.825	25.7*
1.43	14.3
2.13	9.26
2.90	6.21
3.90	4.42
CURVE 33* (T = 2.7)	
0.87	25.7
1.78	19.8
1.86	18.3
2.50	17.1
3.25	15.4
3.94	13.9
CURVE 34 (T = 5.3)	
1.86	8.70
2.50	8.13
3.25	7.14
3.94	6.58
CURVE 35 (T = 6.4)	
0.52	6.94
1.43	6.02
2.50	5.78
3.94	4.95
T	**k**
CURVE 36	
3.80	1.72
4.97	2.33
5.36	2.44

T	k
CURVE 36 (cont.)	
5.74	2.33
7.38	1.67
8.55	1.33
CURVE 37*	
6.39	2.04
H(gauss)	**k**
CURVE 38 (T = 2.5)	
0	1.98
42.5	1.98*
71.2	2.00
145.2	2.01
219.2	2.00*
295.0	1.99*
333.0	2.00*
353.4	2.00*
363.0	2.00*
373.0	1.87
386.0	1.77
411.0	1.62
432.0	1.58
458.0	1.62*
514.0	1.74
560.0	2.02*
600.0	2.54
649.0	3.89
680.0	5.38
706.0	13.5
729.0	15.9
753.0	15.4
795.0	14.9
873.0	14.6
921.0	13.5*
CURVE 39* (T = 2.5)	
685	8.00
600	4.00
486	1.97
369	1.77
247	1.78
149	1.79
69	1.79
0	1.79

T	k
CURVE 40	
0.40	0.0050*
0.44	0.0068*
0.58	0.0165*
0.67	0.0286*
0.68	0.0300*
0.70	0.0365*
0.73	0.0385*
0.75	0.0430
0.79	0.0475
0.82	0.0545
0.86	0.0630
0.90	0.0690
0.94	0.0805
0.99	0.0915
1.03	0.103
1.09	0.133
1.15	0.189
$H(\% H_c)$	**k**
CURVE 41 (T = 0.43)	
0	0.00703*
41	0.00803*
52	0.00789*
62	0.00544*
71	0.00703*
71	0.00737
82	0.0102*
82	0.0109*
91	0.0450
94	0.0641
100	0.225
CURVE 42* (T = 0.43)	
82	0.0752
72	0.0901
62	0.0562
51	0.0281
43	0.0122
42	0.0110
16	0.00775
0	0.00803

* Not shown on plot

DATA TABLE NO. 36 (continued)

H (% H_c)	k
CURVE 43 (T = 0.59K)	
0	0.0212*
14	0.0197*
27	0.0227*
44	0.0256*
45	0.0239*
54	0.0223*
63	0.0136*
73	0.0139*
80	0.0206*
89	0.0348*
100	0.0680
CURVE 44* (T = 0.59K)	
72	0.170
63	0.194
54	0.102
45	0.0439
37	0.0177
CURVE 45 (T = 1.5K)	
0	0.156
6.2	0.154
11	0.172
23	0.166
29	0.161
34	0.156*
41	0.154*
47	0.0775
50	0.0676
53	0.0565
55	0.0556
59	0.0546
61	0.0559
64	0.0602
70	0.0730
76	0.0943
81	0.145
86	0.433

H (% H_c)	k
CURVE 46*	
69	1.35
58	0.699
53	0.469
47	0.254
42	0.169
28	0.126
18	0.123
0	0.120
T	**k**
CURVE 47	
298.2	0.393
318.2	0.385
356.2	0.356
375.2	0.347*
409.2	0.322
437.2	0.305
CURVE 48*	
313.2	0.356
CURVE 49	
405.1	0.356
421.1	0.354
445.1	0.346
467.1	0.343
499.1	0.339
515.1	0.337
521.1	0.337
555.1	0.336
566.1	0.333
570.1	0.331
CURVE 50	
390.1	0.341
423.9	0.331
461.8	0.322
497.5	0.314
499.0	0.313*
528.7	0.307*
539.9	0.303

T	k
CURVE 51	
273.2	0.367
299.7	0.385
326.3	0.400
CURVE 52	
0.157	0.0004*
0.184	0.00068*
0.225	0.0012*
0.275	0.00222*
0.37	0.0040*
0.45	0.0090*
0.47	0.0098*
0.56	0.0193*
0.72	0.039*
0.94	0.086
1.15	0.178
CURVE 53*	
284.5	0.375
295.2	0.361
309.9	0.346
CURVE 54	
83.2	0.448
85.2	0.456
90.2	0.452
261.2	0.385
273.2	0.346*
295.2	0.342*
295.7	0.342*
298.2	0.345*
299.7	0.353*
CURVE 55	
1.44	0.44
1.59	0.79
1.72	1.34
1.90	2.25
1.96	2.55
2.03	3.06
2.14	3.48
2.22	3.93

T	k
CURVE 55 (cont.)	
2.35	4.50
2.43	4.45
2.59	4.70
2.76	4.77
2.94	4.74
3.14	4.70
3.40	4.10
3.61	3.90
3.80	3.70
3.83	3.62*
4.00	3.40*
4.04	3.44*
4.13	3.30
4.40	3.10
4.55	3.01
4.81	2.96*
4.90	2.86
5.42	2.86
5.88	2.96
6.19	3.12*
6.35	3.22
6.57	3.45
6.65	3.60
6.74	3.74*
6.89	3.85
6.99	4.05*
7.14	4.23*
7.25	4.35
7.45	4.00
CURVE 56	
2.92	29.5
3.00	29.5
3.16	35.0
3.39	26.8
3.49	27.7
3.52	30.0
3.69	26.3
3.89	24.1
4.02	21.5
4.32	17.1
4.68	15.7
4.91	14.1
5.21	12.6
5.57	10.4

T	k
CURVE 56 (cont.)	
5.82	9.4
6.06	8.8
6.39	6.75
6.67	5.70
7.00	4.90
7.32	4.27
CURVE 57*	
1.51	0.435
1.70	0.81
1.85	1.28
2.05	1.98
2.20	2.17
2.27	2.25
2.37	3.14
2.45	3.41
2.55	3.60
2.93	4.00
3.11	3.95
3.25	3.87
3.30	3.81
3.49	3.61
3.75	3.39
3.97	3.20
4.07	3.12
4.16	3.09
4.25	3.00
4.29	3.00
4.48	2.88
4.65	2.81
4.97	2.72
5.08	2.72
5.14	2.72
5.25	2.72
5.48	2.72
5.65	2.77
[illegible].69	2.70
5.90	2.85
6.03	2.90
6.13	2.94
6.18	3.00
6.42	3.13
6.57	3.25
6.76	3.50
6.86	3.60

T	k
CURVE 57 (cont.)	
6.98	3.72
7.09	4.00
7.18	4.20
7.31	3.95
7.49	3.67
7.68	3.42
CURVE 58	
2.00	23.6
2.35	25.5
2.49	25.6
2.80	25.0
2.86	24.8
3.19	24.0
3.16	23.4
3.36	22.1
3.62	20.5
3.69	20.0
3.85	19.0
4.15	16.7
4.21	16.4
4.92	12.2
5.00	11.8
5.15	11.0
5.22	10.7*
5.45	9.5*
5.57	9.06*
5.73	8.2*
5.82	8.0*
6.00	7.2*
6.14	6.75*
6.26	6.35*
6.58	5.40*
6.87	4.65*
7.24	4.05*
7.58	3.50*
CURVE 59*	
2.40	1.58
2.49	1.70
2.70	1.98
2.89	2.23
3.06	2.35
3.09	2.30

T	k
CURVE 59* (cont.)	
3.21	2.41
3.31	2.47
3.45	2.47
3.48	2.53
3.74	2.59
3.86	2.53
4.08	2.44
4.22	2.46
4.24	2.41
4.38	2.35
4.45	2.35
4.53	2.35
5.37	2.36
5.44	2.36
5.55	2.36
5.87	2.42
5.98	2.47
6.09	2.52
6.26	2.62
6.60	2.90
6.68	2.94
6.77	3.05
7.08	3.52
7.14	3.45
7.19	3.61
7.23	3.52
7.62	2.94
CURVE 60	
2.41	9.8
2.48	10.2
2.52	10.5
2.69	10.8
2.90	11.3
3.08	12.3
3.57	11.3
3.83	11.3
3.91	11.6
4.16	10.5
4.38	11.1
4.60	9.20
4.75	8.65
4.80	8.45
5.15	7.60
5.48	6.75
5.94	5.65

T	k
CURVE 60 (cont.)	
6.57	4.57
6.61	4.46
7.05	3.83
7.34	3.44
CURVE 61*	
2.40	0.84
2.69	1.25
2.89	1.42
3.06	1.46
3.06	1.55
3.21	1.56
3.30	1.71
3.45	1.62
3.48	1.72
3.72	1.88
3.86	1.84
4.08	1.80
4.22	1.88
4.37	1.94
4.46	1.96
4.53	1.94
5.37	2.14
5.46	2.10
5.53	2.03
5.86	2.17
5.99	2.25
6.10	2.34
6.27	2.34
6.59	2.75
6.66	2.70
6.79	2.67
7.02	3.03
7.14	3.10
7.18	3.01
7.24	3.10
7.68	2.70
CURVE 62	
2.40	3.90
2.45	3.98
2.51	4.50
2.69	4.60
2.88	4.75

* Not shown on plot

DATA TABLE NO. 26 (continued)

T	k
CURVE 62 (cont.)	
3.07	5.15
3.57	5.45
3.84	6.05
4.15	5.90
4.38	6.00
4.58	5.90
4.75	5.90
4.81	5.60
5.15	5.45
5.44	5.15
5.96	4.53
6.59	3.78
7.04	3.40
7.30	3.06
CURVE 63	
1.00	0.27
1.10	0.355
1.15	0.43
1.25	0.54
1.35	0.66
1.50	0.84
1.73	1.15
1.95	1.50
2.15	1.80
2.55	2.30
2.70	2.45
2.85	2.60
3.25	2.85
3.50	2.95
3.90	2.90
4.35	2.60
CURVE 64	
1.03	0.110
1.18	0.160
1.28	0.220
1.45	0.300
1.60	0.415
1.90	0.68
2.10	1.02
2.40	1.60
2.60	2.10

T	k
CURVE 64 (cont.)	
2.80	2.40
3.05	2.70*
3.80	3.00
4.0	2.80
CURVE 65*	
1.08	0.180
1.10	0.205
1.18	0.250
1.30	0.33
1.48	0.51
1.68	0.70
1.90	1.00
2.10	1.25
2.35	1.70
2.50	1.90
2.80	2.30
3.05	2.45
3.30	2.60
3.70	2.65
3.95	2.60
4.40	2.50
CURVE 66*	
313.4	0.322
336.2	0.320
362.2	0.303
381.6	0.310
428.7	0.311
CURVE 67	
0.405	0.00375*
0.43	0.005*
0.585	0.011*
0.715	0.024*
0.74	0.027*
0.79	0.035*
0.815	0.038*
0.88	0.045
0.92	0.050
0.955	0.0578
1.00	0.065
1.10	0.0725*
1.15	0.095

T	k
CURVE 68*	
0.295	0.0019
0.37	0.0032
0.41	0.0055
0.475	0.0060
0.50	0.0075
0.54	0.0114
0.675	0.0215
0.675	0.0225
0.75	0.0310
0.805	0.0315
0.87	0.0402
CURVE 69	
2.7	0.535
3.0	0.570
4.0	0.670
5.0	0.765
6.0	0.907
6.5	1.00
7.0	1.13
7.15	1.16
CURVE 70	
2.5	0.66
3.0	0.825
3.5	0.95
4.0	1.04
5.0	1.22
5.7	1.26
6.0	1.25
7.0	1.18
8.0	1.08
9.0	0.985
10.0	0.91
11.0	0.84
CURVE 71*	
327.2	0.347
CURVE 72	
3.47	1.59

T	k
CURVE 73*	
4.37	2.22
4.64	2.33
CURVE 74*	
322.0	0.321
340.8	0.320
358.0	0.319
376.3	0.317
413.5	0.310
CURVE 75*	
319.0	0.331
341.7	0.319
383.4	0.320
383.2	0.312
419.2	0.308
CURVE 76*	
319.3	0.341
341.2	0.335
361.0	0.330
384.7	0.328
CURVE 77*	
320.9	0.338
338.1	0.341
360.8	0.337
382.1	0.332
415.9	0.309
CURVE 78*	
315.5	0.322
335.2	0.331
355.4	0.322
378.5	0.322
398.2	0.318
CURVE 79*	
319.2	0.339
338.8	0.331
362.5	0.322

T	k
CURVE 79* (cont.)	
382.0	0.318
399.5	0.318
CURVE 80*	
316.4	0.327
341.5	0.327
359.9	0.325
378.7	0.324
436.1	0.321
CURVE 81*	
321.9	0.335
345.5	0.322
365.0	0.322
385.0	0.318
401.1	0.318
CURVE 82*	
313.7	0.332
336.1	0.336
355.2	0.331
380.2	0.328
404.7	0.318
CURVE 83*	
2.61	0.305
2.70	0.295
2.75	0.315
3.19	0.385
3.44	0.431
3.60	0.465
3.90	0.505
4.35	0.528
4.85	0.575
8.50	0.690
9.00	0.675
9.40	0.650
CURVE 84*	
2.70	0.250
2.70	0.263
2.90	0.293

T	k
CURVE 84 (cont.)*	
3.01	0.290
3.15	0.325
3.25	0.260
3.51	0.358
3.62	0.368
4.45	0.426
4.78	0.470
4.80	0.450
6.35	0.596
CURVE 85*	
314.1	0.322
337.6	0.326
361.4	0.318
381.4	0.314
CURVE 86*	
323.5	0.326
341.6	0.326
361.4	0.322
381.7	0.322
401.3	0.318
CURVE 87*	
314.3	0.331
352.6	0.326
364.9	0.331
385.5	0.326
414.1	0.322
CURVE 88*	
850	0.156
900	0.157
1000	0.158
1100	0.159
1200	0.160
1250	0.160
CURVE 89*	
373.2	0.356
423.2	0.347
473.2	0.339

T	k
CURVE 90*	
328.2	0.356
348.2	0.351
383.2	0.345
393.2	0.344
426.2	0.339
436.2	0.337
465.2	0.333
483.2	0.331
503.2	0.326
523.2	0.324
CURVE 91*	
328.2	0.356
348.2	0.351
383.2	0.345
393.2	0.344
426.2	0.339
436.2	0.337
465.2	0.333
483.2	0.331
503.2	0.326
523.2	0.324
CURVE 92*	
380.2	0.343
398.2	0.339
426.2	0.335
453.2	0.331
468.2	0.328
498.2	0.324
510.2	0.322
CURVE 93*	
373.2	0.333
423.2	0.324
473.2	0.317
CURVE 94	
298.0	0.337

T	k
CURVE 95	
20.4	0.476
22.4	0.465
26.2	0.451
85.7	0.397
273.0	0.372
CURVE 96*	
20.6	0.577
22.4	0.543
25.9	0.489
86.0	0.401
273.0	0.372
CURVE 97*	
700.2	0.153
705.2	0.154
738.2	0.150
757.2	0.161
765.2	0.150
765.7	0.158
773.0	0.153
773.0	0.159
794.2	0.161
800.0	0.156
800.7	0.160
804.2	0.157
804.7	0.152
817.2	0.156
826.2	0.157
830.7	0.151
831.2	0.155
836.0	0.157
840.0	0.155
844.2	0.152
868.2	0.163
890.2	0.167
892.2	0.161
897.7	0.166
898.7	0.171
903.2	0.165
910.6	0.169
916.7	0.162
923.7	0.164
931.2	0.180
937.2	0.168

* Not shown on plot

DATA TABLE NO. 26 (continued)

T	k
CURVE 97 (cont.)*	
941.2	0.169
941.2	0.179
955.7	0.180
966.2	0.180
971.7	0.183
980.0	0.173
983.2	0.179
996.7	0.186
998.2	0.182
1000.2	0.178
1002.7	0.189
1020.2	0.188
1023.2	0.182
1045.7	0.192
1059.2	0.200
1061.2	0.196
1063.2	0.202
1066.2	0.194
1069.2	0.189
1089.2	0.198
1099.2	0.212
1105.2	0.197
1130.2	0.209

T	k
CURVE 98*	
293.1	0.351
303.6	0.350
315.0	0.346
327.2	0.343
346.5	0.344

T	k
CURVE 99*	
318.9	0.324
349.7	0.331
386.8	0.318
410.8	0.312

T	k
CURVE 100*	
327.6	0.324
355.4	0.317
378.7	0.317
404.7	0.313

T	k
CURVE 101*	
317.2	0.324
353.1	0.324
376.2	0.320

T	k
CURVE 102*	
273.2	0.350
373.2	0.320

H(gauss)	k
CURVE 103* (T = 2.7K)	
0	0.62
225	0.63
340	0.64
418	0.63
498	0.65
538	0.65
555	0.65
576	0.65
593	0.65
611	0.70
630	0.68
650	0.72
690	0.73
702	0.98
730	4.45
745	4.45
788	4.45
815	4.50
1000	4.49

H(gauss)	k
CURVE 104* (T = 2.7K)	
1000	4.49
798	4.55
750	4.55
732	4.54
720	4.50
699	3.48
683	2.02
665	1.35
CURVE 104 (cont.)*	
625	0.86
605	0.80
566	0.76
529	0.70
485	0.70
410	0.68
0	0.61

H(gauss)	k
CURVE 105 (T = 4.6K)	
0	1.80
312	1.80
338	1.81*
362	1.82*
376	1.83
389	1.84
400	1.89
415	2.00
437	2.45
441	2.68
464	2.80*
484	3.60
496	4.50
494	5.15
724	5.50
1000	5.50

H(gauss)	k
CURVE 106 (T = 4.6K)	
33	1.90
180	1.90
262	1.91
336	2.00
364	2.05
382	2.10
406	2.20
428	2.75
454	3.61
463	4.65
466	5.55
490	5.55
524	5.55
610	5.55

H(gauss)	k
CURVE 107 (T = 5.29K)	
0	0.863
120	0.863
145	0.866*
183	0.869*
220	0.869*
262	0.869*
277	0.874
292	0.878*
300	0.880*
312	0.922
328	0.944
340	1.062
360	1.261
382	1.275
402	1.283*
462	1.285*
731	1.275
1000	1.265*

H(gauss)	k
CURVE 108* (T = 5.29K)	
1000	1.265
809	1.265
498	1.260
461	1.260
438	1.259
420	1.252
402	1.251
391	1.252
375	1.247
355	1.240
320	0.980
300	0.937
285	0.910
262	0.894
225	0.884
45	0.875

H(gauss)	k
CURVE 109* (T = 5.40K)	
0	0.835
145	0.836
165	0.839
182	0.850
205	0.882
225	0.910
259	0.951
265	0.981
305	1.070
345	1.189
360	1.210
380	1.220
417	1.220
539	1.220
1000	1.230

H(gauss)	k
CURVE 110* (T = 5.40K)	
996	1.240
725	1.230
610	1.235
490	1.230
450	1.230
430	1.230
410	1.232
390	1.235
378	1.235
360	1.235
338	1.203
320	1.148
300	1.112
265	1.020
226	0.950
205	0.922
190	0.896
168	0.885
150	0.876
113	0.865
40	0.860
0	0.855

H(gauss)	k
CURVE 111 (T = 2.89K)	
0	0.540
140	0.550
220	0.550
260	0.550
300	0.549*
340	0.551*
380	0.472
418	0.450
458	0.461
500	0.490
539	0.535*
580	0.602
614	0.675
653	0.788*
692	0.802
729	0.803*
1000	0.805*

H(gauss)	k
CURVE 112* (T = 2.89K)	
1000	0.805
928	0.806
800	0.812
725	0.808
685	0.808
642	0.808
602	0.698
570	0.626
530	0.558
490	0.506
450	0.470
412	0.440
370	0.420
340	0.412
300	0.408
262	0.406
225	0.404
0	0.403

H(gauss)	k
CURVE 113* (T = 2.92K)	
0	0.555
14[illegible]	0.561
CURVE 113 (cont.)*	
338	0.560
535	0.560
578	0.560
613	0.568
633	0.600
652	0.698
686	0.849
728	0.849
925	0.851
1000	0.852

H(gauss)	k
CURVE 114* (T = 2.92K)	
1000	0.852
793	0.858
688	0.856
660	0.855
645	0.785
600	0.560
580	0.505
560	0.487
478	0.460
409	0.442
335	0.440
212	0.437
0	0.430

T	k
CURVE 115*	
2.60	0.653
2.86	0.800
3.36	0.887
3.82	1.015
4.47	1.110
5.38	1.260
5.80	1.250
6.00	1.240
6.71	1.205
7.35	1.150
7.63	1.137
8.11	1.073
9.54	0.931
10.60	0.870
11.44	0.809
14.96	0.637
CURVE 115 (cont.)*	
20.36	0.508
21.03	0.530

T	k
CURVE 116*	
2.82	0.545
3.32	0.618
3.81	0.653
4.38	0.697
4.58	0.733
5.42	0.844
5.82	0.905
6.50	0.990
6.72	1.065
6.72	1.090
7.21	1.160

T	k
CURVE 117*	
2.67	0.308
3.03	0.411
3.03	0.425
3.42	0.500
3.92	0.583

T	k
CURVE 118	
7.215	5.043
7.226	5.009*
7.236	5.012*
7.244	4.983*
7.270	4.976
7.283	4.910
7.297	4.889*
7.387	4.756
7.455	4.661*
7.491	4.609
7.505	4.595
7.629	4.431
7.662	4.403*
7.765	4.277*
7.797	4.239
7.835	4.206
7.964	4.057
7.980	4.043*
8.113	3.905
8.270	3.754

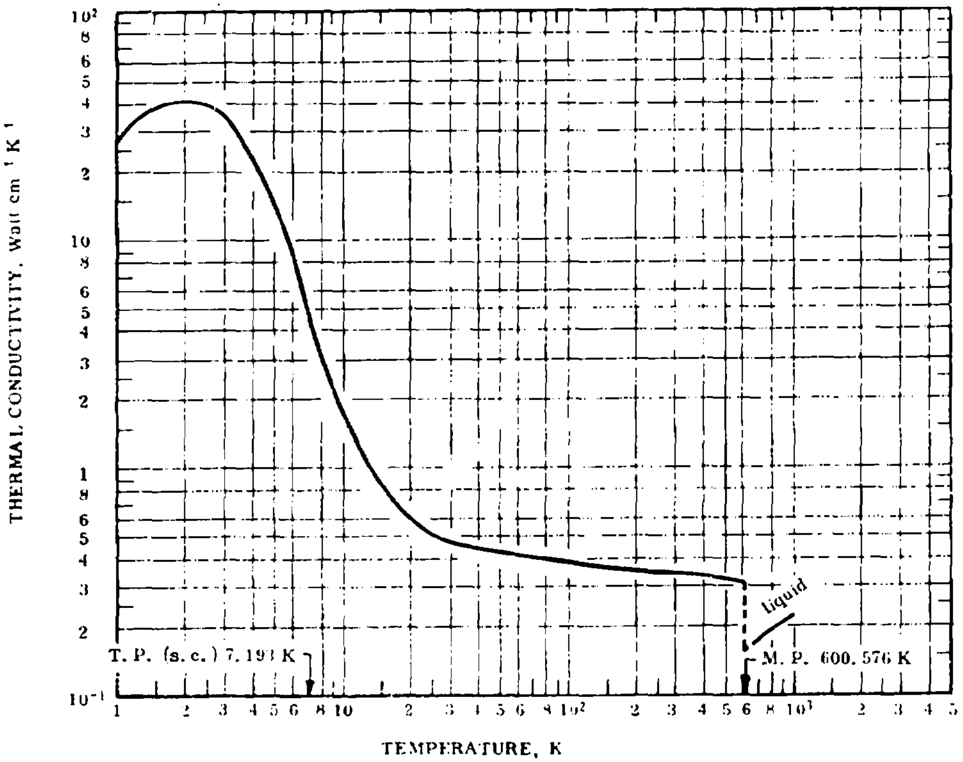
*Not shown on plot

DATA TABLE NO. 26 (continued)

T	k
CURVE 119*	
6.409	6.790
6.519	6.506
6.683	6.143
6.932	5.617
7.009	5.451
7.110	5.238
7.164	5.159
7.219	5.055
7.351	4.811
7.412	4.721
7.591	4.491
7.899	4.143
8.044	3.982
8.208	3.813
8.290	3.733
CURVE 120*	
6.279	7.063
6.371	6.909
6.564	6.418
6.623	6.299
6.872	5.752
6.955	5.570
7.064	5.363
7.195	5.096
7.225	5.024
7.250	4.989
7.292	4.901
7.329	4.859
7.518	4.574
7.561	4.515
7.695	4.354
7.867	4.159
7.946	4.081
8.058	3.970
8.150	3.868
8.157	3.863
8.167	3.851
8.310	3.721
CURVE 121*	
6.225	7.264
6.273	7.134
6.332	6.968
CURVE 121 (cont.)*	
6.756	6.044
6.813	5.873
7.27	4.937
CURVE 122*	
5.484	2.524
5.407	2.542
5.626	2.585
5.793	2.555
5.911	2.668
6.002	2.732
5.002	2.592
6.070	2.699
6.131	2.810
6.130	2.839
6.219	2.962
6.272	2.974
6.326	3.140
6.376	3.211
6.414	3.246
6.491	3.424
6.521	3.455
6.575	3.592
6.583	3.607
6.618	3.751
6.670	3.803
6.669	3.886
6.759	4.000
6.816	4.187
6.880	4.263
6.932	4.348
6.955	4.450
6.988	4.474
7.008	4.607
7.051	4.588
7.066	4.628
7.117	4.697
7.118	4.761
7.161	4.836
7.198	4.919
7.190	4.960
7.215	4.964
7.211	4.988
CURVE 123*	
291.3	0.356
300.6	0.356
308.5	0.360
317.6	0.368
323.9	0.368
333.2	0.372
CURVE 124*	
302.0	0.358
315.7	0.356
329.8	0.356
CURVE 125	
616.5	0.175
644.3	0.180
699.8	0.189
755.4	0.196
CURVE 126*	
0.129	0.0000467
0.162	0.0001170
0.221	0.0000885
0.292	0.0001010
CURVE 127*	
0.176	0.0000182
0.214	0.0000310
0.255	0.0000292
0.303	0.0000346
0.363	0.0000234
CURVE 128*	
0.186	0.0000182
0.239	0.0000228
0.309	0.0000410
0.378	0.0000583
CURVE 129*	
0.015	0.0415
0.0155	0.032
CURVE 129 (cont.)*	
0.0168	0.057
0.0175	0.0455
0.020	0.0575
0.0205	0.067
0.025	0.068
0.023	0.058
0.024	0.057
0.025	0.0765
0.0265	0.075
0.028	0.0725
0.029	0.086
0.031	0.083
0.034	0.086
0.0355	0.102
0.0355	0.110
0.039	0.110
0.0425	0.140
0.046	0.143
0.054	0.155
0.061	0.195
0.066	0.200
0.073	0.215
0.081	0.250
0.093	0.285
0.103	0.320
0.110	0.350
0.125	0.385
0.140	0.435
0.165	0.50
0.185	0.565
0.215	0.65
0.23	0.71
CURVE 130	
0.105	0.0490*
0.155	0.0691*
0.26	0.0864*
0.41	0.170
CURVE 131	
0.198	0.150*
0.240	0.259*
0.375	0.295
CURVE 132	
0.42	0.662
CURVE 133	
0.14	0.156*
0.285	0.360*
0.44	1.44
CURVE 134	
323.2	0.343
CURVE 135	
560	0.324
605	0.318
605	0.167
700	0.166
800	0.164
900	0.162
1000	0.161
1100	0.159*
1200	0.157
1300	0.156*
1355	0.155*
CURVE 136	
474.2	0.3056*
545.2	0.2972
588.2	0.2930
627.2	0.1716
683.2	0.1716*
740.2	0.1800
823.2	0.1925
870.2	0.1967
CURVE 137*	
223	0.362
273	0.355
323	0.349
373	0.342
423	0.335
473	0.328
523	0.321
573	0.315
CURVE 138*	
223	0.360
273	0.353
323	0.346
373	0.339
423	0.332
473	0.324
523	0.317
573	0.310
CURVE 139*	
334.8	0.3581
336.7	0.3580
336.7	0.3593
367.3	0.3562
369.2	0.3541
370.7	0.3613
413.2	0.3514
416.0	0.3501
417.9	0.3522
436.5	0.3503
442.3	0.3500
468.9	0.3443
601.5	0.3390
CURVE 140*	
316.2	0.341
335.2	0.341
336.2	0.339
335.2	0.340
347.2	0.341
349.2	0.338
357.2	0.334
358.2	0.332
372.2	0.333
373.2	0.329
377.2	0.329
381.2	0.330
389.2	0.328
391.2	0.332
401.2	0.325
420.2	0.321
CURVE 141*	
323.2	0.350
340.2	0.345
362.2	0.339
380.2	0.338
389.2	0.343
395.2	0.335
402.2	0.343
414.2	0.335
434.2	0.334
CURVE 142	
337.6	0.331*
380.2	0.321
398.9	0.314

* Not shown on plot

FIGURE AND TABLE NO. 26R RECOMMENDED THERMAL CONDUCTIVITY OF LEAD



REMARKS

The recommended values are for well-annealed 99.99^{+}% pure lead with residual electrical resistivity ρ_0 = 0.000880 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 80 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 3.00, α' = 7.40 x 10^{-4}, and β = 0.0353. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature, and 3 to 10% at other temperatures.

RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	27.7	1600	-457.9
2	42.4	2450	-456.1
3	34.0	1960	-454.3
4	22.4	1290	-452.5
5	13.8	797	-450.7
6	8.2	474	-448.9
7	4.9	283	-447.1
8	3.2	185	-445.3
9	2.3	133	-443.5
10	1.78	103	-441.7
11	1.46	84.4	-439.9
12	1.23	71.1	-438.1
13	1.07	61.8	-436.3
14	0.94	54.3	-434.5
15	0.84	48.5	-432.7
16	0.77	44.5	-430.9
18	0.66	38.1	-427.3
20	0.59	34.1	-423.7
25	0.507	29.3	-414.7
30	0.477	27.6	-405.7
35	0.462	26.7	-396.7
40	0.451	26.1	-387.7
45	0.442	25.5	-378.7
50	0.435	25.1	-369.7
60	0.424	24.5	-351.7
70	0.415	24.0	-333.7
80	0.407	23.5	-315.7
90	0.401	23.2	-297.7
100	0.396	22.9	-279.7
150	0.377	21.8	-189.7
200	0.366	21.1	-99.7
250	0.358	20.7	-9.7
273.2	0.355	20.5	32.0
300	0.352	20.3	80.3
350	0.346	20.1	170.3
400	0.338	19.5	260.3
500	0.325	18.8	440.3
600	0.312	18.0	620.3
600.5	0.312	18.0	621.2

T_1	k_1	k_2	T_2
In Liquid State			
600.6	(0.155)‡	(8.96)	621.4
700	0.174	10.1	800.3
800	0.190	11.0	980.3
900	0.203	11.7	1160
1000	0.215	12.4	1340

*T_1 in K, k_1 in Watt cm^{-1}K^{-1}, T_2 in F, and k_2 in Btu hr^{-1}ft^{-1}F^{-1}.

‡Values in parentheses are extrapolated.

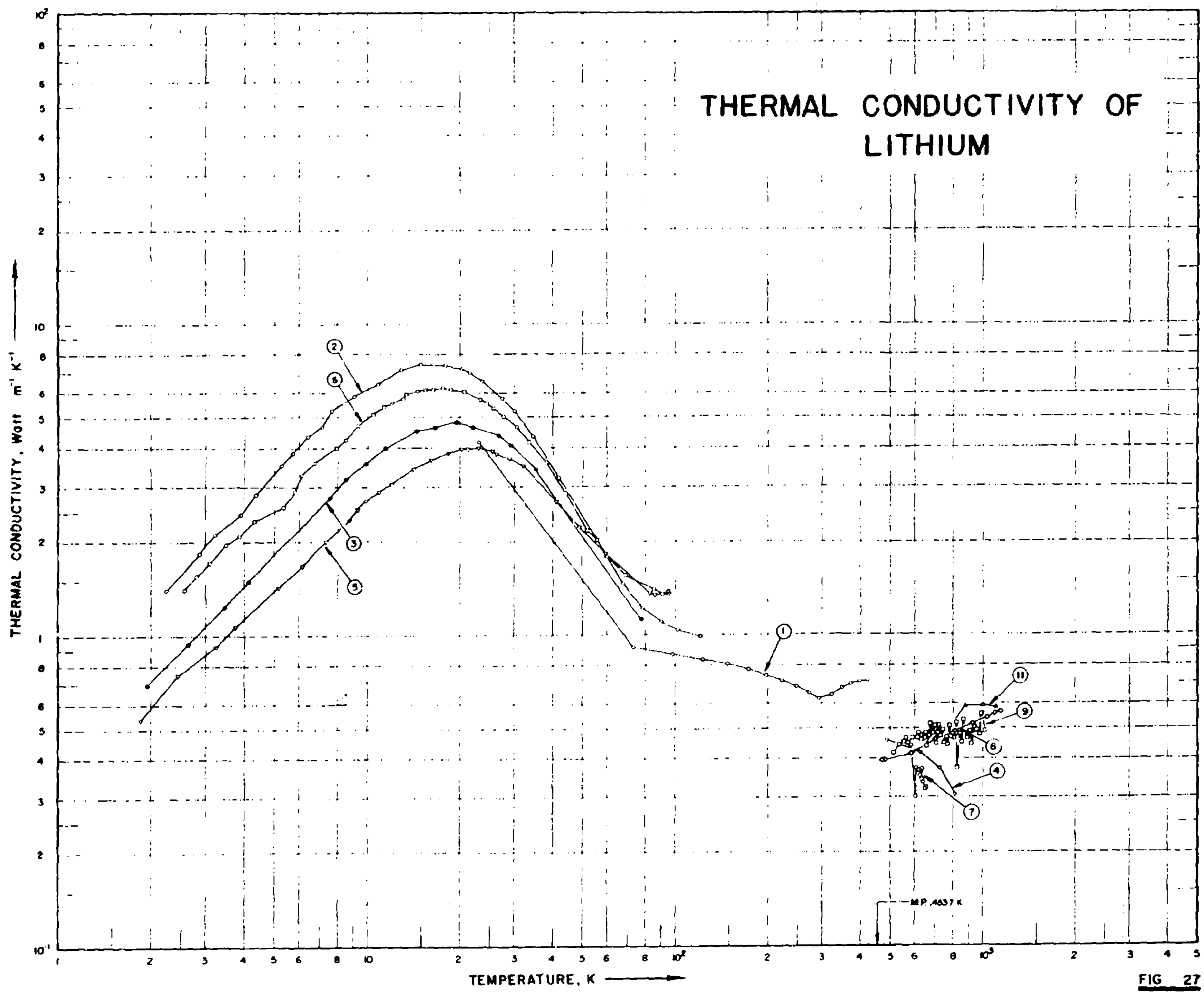

THERMAL CONDUCTIVITY OF LITHIUM
THERMAL CONDUCTIVITY, Watt m⁻¹ K⁻¹
TEMPERATURE, K
M.P. 453.7 K
1
2
3
4
5
6
7
9
11

FIG 27

SPECIFICATION TABLE NO. 27 THERMAL CONDUCTIVITY OF LITHIUM

[For Data Reported in Figure and Table No. 27]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	12	F	1926	23-423			Pure; 1.10 cm dia and 25 cm long; extruded; electrical conductivity reported as 1050, 135, 57.8, 36.1, 26.9, 21.1, 17.5, 15.00, 12.85, 11.55, 10.35, 9.44, 8.70, 8.13, 7.57, and 7.14 x 10^4 ohm^{-1} cm^{-1} at 23, 73, 98, 123, 148, 173, 198, 223, 248, 273, 298, 323, 348, 373, 398, and 423 K, respectively.
2	52	L	1966	2.2-121		Li 2	High purity; 1.6 mm dia, supplied by A.D. Mac Kay (New York); extruded; electrical resistivity ratio ρ(295 K)/ρ(0 K) = 234 (using Gunty and Broniewski's value ρ(295 K) = 9.44 μ ohm cm).
3	99	L	1964	2.0-79		Li 3	High purity; 1.4 mm dia; supplied by New Metals and Chemical Ltd (London); ρ(295 K)/ρ(0 K) = 137 (using Gunty and Broniewski's value ρ(295 K) = 9.44 μohm cm).
4	342	C	1953	499-812	10		99.8 Li, 0.005 Cl, 0.03 N, 0.09 heavy metals, 0.02 Na, 0.06 Ca, 0.03 Fe and Al, 0.015 Si; specimen in liquid state; supplied by Maywood Chemical Works; 1.999 in. dia; Armco iron used as comparative material.
5	223	L	1956	1.9-96		Li 1	High purity; possibly contaminated with Cu; 0.53 mm dia; distilled; electrical resistivity 8.98 μ ohm cm at room temperature and 0.084 μ ohm cm at 0 K; electrical resistivity ratio ρ(room temp)/ρ(0 K) = 100.
6	223	L	1956	2.6-95		Li 2	Similar to the above specimen but no Cu contamination; electrical resistivity 9.17 μ ohm cm at room temperature and 0.0455 μ ohm cm at 0 K; ρ(room temp)/ρ(0 K) = 200.
7	243	L	1950	543-652	10		Composition before test: 99.52$^+$ Li (by difference), 0.1 Ca, 0.1 Si, < 0.1 Hg, < 0.1 P, < 0.01 Al, < 0.01 B, < 0.01 Cr, < 0.01 Cu, < 0.01 Fe, < 0.01 K, < 0.01 Na, and < 0.01 Ni; after test: 99.22$^+$ Li (by difference), 0.1 Ca, < 0.1 Hg, < 0.1 P, 0.1 Al, 0.2 B, 0.02 Cr, 0.04 Cu, < 0.01 K, < 0.1 Na and < 0.01 Ni; specimen in liquid state; 0.084 in. dia; supplied by Maywood Chemical Company; M.P. 186 C.
8	595, 462	-	1961	467-1128			(Nominal specification): 99.9 Li (min), 0.03 Na, 0.01 K, 0.01 Ca, 0.002 Cl, 0.01 N, 0.005 Fe, 0.01 Ni, and 0.002 Cr; posttest 0.04 Na, 0.23 N, 0.012 Fe, 0.004 Ni, and 0.013 Cr; specimen in liquid state; 0.59 in. dia; electrical resistivity reported as 25.6, 25.8, 29.7, 33.1, 35.9, 38.5, 41.2, 42.5, and 43.8 μohm cm at 193.6, 199.2, 309.4, 422.2, 535.0, 644.4, 753.6, 808.3, and 864.4 C, respectively; data calculated from Wiedemann Franz-Lorenz relationship using L = 2.16 x 10^{-8} V^{2}K^{-2}, this value being based on unpublished thermal conductivity values of 0.416, 0.428, and 0.496 at 283.3, 362.8 and 522.8 C that had been obtained from C.T. Ewing of the Naval Research Laboratory, Washington.
9	919, 592	L	1958	511-1012			M.P. 186 C; data in liquid state; measured in vacuum (~4 x 10^{-4} mm Hg).
10	764, 763, 471	C	1964	596-1052	± 4 - 15		Composition before test: 99.82 Li (by difference), 0.015 Na, 0.06 K, 0.0001 Ca, 0.0005 Al, 0.001 Si, 0.04 Cl, 0.012 N, < 0.0015 Ni, < 0.0015 Cr, < 0.0010 Ti, 0.0062 N, 0.0003 O, 0.0027 Fe, and 0.025 others; after test: values assumed to remain the same except 0.0058 Si, 0.0022 Ni, < 0.001 Cr, < 0.002 Mn, and 0.0024 Fe; 99.81 Li (by difference), specimen in liquid state; supplied by the Foote Mineral Company; measured in vacuum (3 x 10^{-5} mm Hg); type 347 stainless steel used as comparative material; data calculated by comparing to the top reference material (between heater and specimen).

SPECIFICATION TABLE NO. 27 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
11	764, 767, 871	C	1965	631-1100	5 - 15		Data of the above specimen calculated by comparing with the bottom reference material (Armco iron, between specimen and heat sink).
12	459, 460	-	1965	461-1366			Density reported as 0.4992, 0.4898, 0.4724, 0.4654, 0.4581, 0.4440, and 0.4289 g cm^{-3} at 615.8, 714.3, 862.7, 940.4, 1054, 1157 and 1311 K, respectively; electrical resistivity reported as 12.16, 13.36, 14.73, 15.54, 26.54, 28.30, 30.39, 31.02, 32.10, 33.40, 34.90, 35.99, 37.53, 38.61, 39.97, 41.53, 42.68, 46.05, 48.21, 48.96, and 49.67 μ ohm cm at 360, 394, 432, 451, 487, 536, 597, 604, 655, 696, 764, 815, 878, 918, 983, 1045, 1104, 1246, 1319, 1342, and 1372 K, respectively; thermal conductivity data calculated from measured electrical resistivity values and the Lorenz number 2.45 x 10^{-8} V^2K^{-2}.
13	969	-	1965	589-1723			0.0490 O, 0.0130 Na, < 0.0010 Fe, < 0.0010 Ni, < 0.0010 N, < 0.0005 Nb, and < 0.0005 Zr; posttest impurities 0.24 O, < 0.01 Fe, < 0.01 Nb, < 0.0030 N, < 0.0010 Ni, < 0.0010 Zr, and < 0.0002 C; molten specimen contained in a Nb-1Zr alloy capsule; electrical resistivity reported as 27.2, 29.9, 32.7, 35.4, 38.1, 40.8, 43.5, 46.1, 48.6, 51.2, 53.7, 56.1, and 59.1 μ ohm cm at 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, and 1430 C, respectively; data calculated from the measured electrical resistivity data and the Lorenz number 2.29 x 10^{-8} V^2K^{-2}, this value being based on measured thermal conductivity data of Cooke, J.W. (J. Chem. Phys., 40 (7), 1902-9, 1964).

DATA TABLE NO. 27 THERMAL CONDUCTIVITY OF LITHIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
23	4.184
73	0.912
98	0.868
123	0.837
148	0.803
173	0.774
198	0.741
223	0.711
248	0.682
273	0.643
298	0.623
323	0.640
348	0.674
373	0.695
398	0.707
423	0.711
CURVE 2	
2.24	1.402
2.87	1.829
3.22	2.135
3.91	2.460
4.37	2.828
5.29	3.317
5.75	3.862
6.44	4.368
7.13	4.678
7.70	5.241
9.08	5.829
10.80	6.437
12.87	7.149
14.94	7.425
17.93	7.379
20.23	7.184
21.50	6.906
23.60	6.575
27.47	5.747
30.11	5.218
34.48	4.345
41.84	3.195
55.63	2.023
CURVE 2 (cont.)	
67.80	1.470
78.50	1.218
90.0	1.105
102.30	1.035
121.15	0.990
CURVE 3	
1.95	0.690
2.64	0.943
3.45	1.230
4.14	1.494
7.59	2.760
8.51	3.172
9.90	3.563
11.50	3.996
14.48	4.506
16.67	4.644
19.54	4.810
22.07	4.644
26.57	4.370
29.20	4.070
35.17	3.402
77.70	1.126
CURVE 4	
488.7	0.459
623.2	0.419
720.9	0.372
811.6	0.367
CURVE 5	
1.85	0.518
2.45	0.749
3.25	0.924
3.75	1.064
5.15	1.427
6.18	1.673
7.35	2.000
8.75	2.350
CURVE 5 (cont.)	
9.30	2.358
9.90	2.700
10.90	2.883
12.00	3.053
14.10	3.415
16.30	3.630
18.30	3.850
20.15	3.965
21.10	3.975
22.95	4.000
25.40	3.905
26.20	3.825
28.90	3.685
31.95	3.510
41.00	2.680
48.70	2.235
59.25	1.835
82.75	1.370
85.99	1.350
95.60	1.368
CURVE 6	
2.56	1.405
2.80	1.555
3.09	1.705
3.50	1.760
3.85	2.080
4.30	2.340
5.36	2.585
5.83	2.890
6.12	3.275
6.76	3.590
7.93	4.000
8.50	4.250
9.33	4.713
10.59	5.123
11.42	5.380
12.00	5.530
13.05	5.755
13.40	5.905
CURVE 6 (cont.)	
14.57	6.080
15.50	6.150
16.43	6.165
17.60	6.235
18.65	6.165
20.63	6.080
23.30	5.695
24.48	5.555
25.65	5.345
27.62	5.030
30.54	4.630
33.60	4.185
38.10	3.600
44.05	2.855
51.75	2.185
55.70	2.025
59.90	1.790
69.00	1.560
84.90	1.405
90.33	1.315
94.60	1.380
CURVE 7	
583.2	0.439
602.2	0.401
609.2	0.372
617.2	0.364
623.2	0.351
631.2	0.372
634.2	0.343
638.2	0.335
639.2	0.315
643.2	0.311
646.2	0.318
649.2	0.322
650.2	0.322
651.2	0.322
652.2	0.322
CURVE 8	
466.8	0.394
472.4	0.395
582.4	0.424
695.4	0.459
808.2	0.488
917.6	0.516
1026.8	0.539
1081.5	0.553
1137.6	0.561
CURVE 9	
511.2	0.418
535.7	0.442
554.2	0.451
561.2	0.466
569.2	0.447
572.2	0.465
588.2	0.465
592.2	0.465
604.2	0.464
611.2	0.465
616.0	0.452
627.2	0.474
628.2	0.459
630.7	0.425
647.2	0.463
652.2	0.482
655.2	0.436
668.2	0.472
671.2	0.517*
672.7	0.463*
680.2	0.464*
684.2	0.453
685.2	0.479
694.2	0.506
698.0	0.488*
708.0	0.445
713.2	0.481
716.2	0.509
724.2	0.489*
CURVE 9 (cont.)	
725.2	0.471
743.2	0.494
745.2	0.447*
756.2	0.493*
759.2	0.478
763.2	0.465
768.2	0.442
773.2	0.465
779.2	0.465
779.7	0.507
784.2	0.459
785.2	0.506*
788.2	0.487*
798.2	0.477*
801.2	0.465*
806.2	0.459*
818.2	0.479
818.7	0.517
821.2	0.372
823.2	0.463*
829.5	0.373*
843.2	0.477
850.2	0.449
861.2	0.471*
862.8	0.529
882.2	0.487*
888.2	0.465
891.2	0.457*
898.2	0.473*
905.2	0.488
913.2	0.445
919.2	0.459*
935.2	0.504
938.2	0.475*
948.2	0.490
962.2	0.506*
973.2	0.476
985.2	0.552
998.2	0.529*
1010.7	0.556*
1012.2	0.488
CURVE 10*	
596.4	0.449
600	0.446
615.1	0.449
651.7	0.460
652.2	0.467
655.8	0.457
722.0	0.475
722.9	0.479
825.0	0.558
942.7	0.562
945.8	0.555
936.9	0.552
1051.6	0.549
CURVE 11	
631.4	0.457*
633.2	0.464*
649.5	0.160*
691.6	0.474*
691.6	0.483*
770.9	0.497*
771.6	0.500*
873.7	0.587
987.9	0.586*
993.5	0.585*
997.0	0.587
1103.4	0.582
CURVE 12*	
463	0.409
478	0.416
533	0.446
589	0.471
700	0.515
811	0.555
922	0.591
1033	0.621
1144	0.645
1255	0.662
1366	0.675

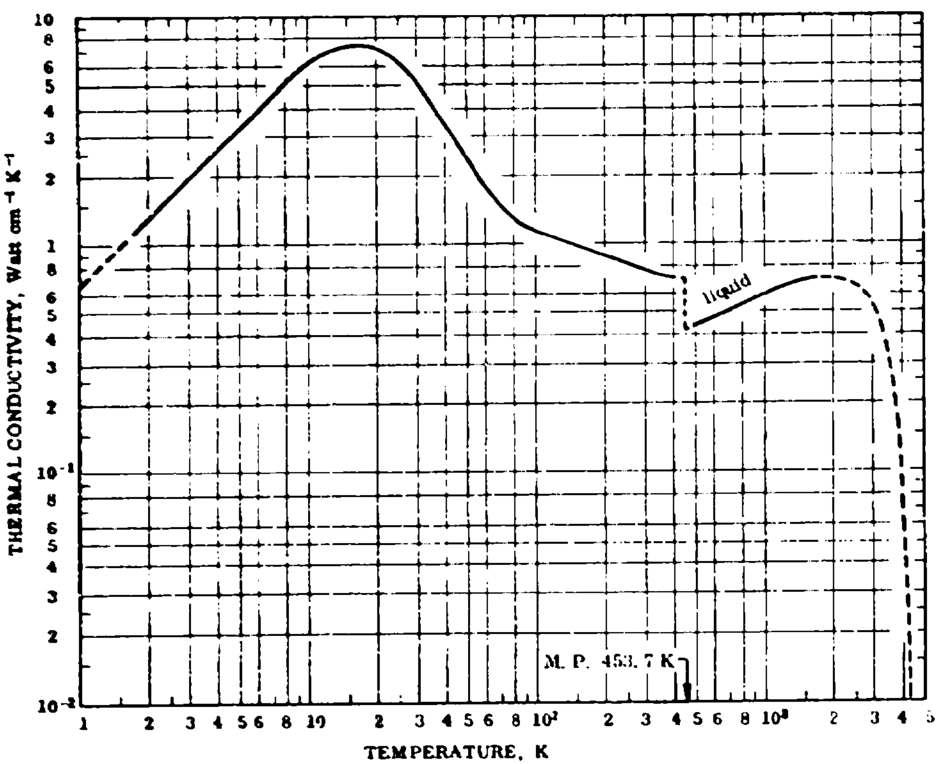
* Not shown on Plot

DATA TABLE NO. 27 (continued)

T	k
CURVE 13	
568.9	0.445*
673.2	0.471*
773.2	0.502*
873.2	0.525*
973.2	0.547*
1073	0.566
1173	0.583
1273	0.599
1373	0.614
1473	0.628
1573	0.643
1723	0.661

*Not shown on plot

FIGURE AND TABLE NO. 27R RECOMMENDED THERMAL CONDUCTIVITY OF LITHIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.658)‡	(38.0)	-457.9
2	1.32	76.3	-456.1
3	1.97	114	-454.3
4	2.62	151	-452.5
5	3.29	190	-450.7
6	3.86	223	-448.9
7	4.56	263	-447.1
8	5.15	298	-445.3
9	5.67	328	-443.5
10	6.13	354	-441.7
11	6.51	376	-439.9
12	6.82	394	-438.1
13	7.09	410	-436.3
14	7.25	419	-434.5
15	7.38	426	-432.7
16	7.40	428	-430.9
18	7.39	427	-427.3
20	7.20	416	-423.7
25	6.30	364	-414.7
30	5.20	300	-405.7
35	4.22	244	-396.7
40	3.43	198	-387.7
45	2.81	162	-378.7
50	2.35	136	-369.7
60	1.79	103	-351.7
70	1.50	86.7	-333.7
80	1.32	76.3	-315.7
90	1.21	69.9	-297.7
100	1.14	65.9	-279.7
150	0.977	56.5	-189.7
200	0.881	50.9	- 99.7
250	0.817	47.2	- 9.7
273.2	0.792	45.8	32.0
300	0.768	44.4	80.3
350	0.738	42.6	170.3
400	0.721	41.7	260.3
453.7	(0.712)	(41.1)	357.0

T_1	k_1	k_2	T_2
	In Liquid State		
453.7	(0.428)	(24.7)	357.0
500	0.443	25.6	440.3
600	0.476	27.5	620.3
700	0.509	29.4	800.3
800	0.541	31.3	980.3
900	0.572	33.1	1160
1000	0.600	34.7	1340
1100	0.625	36.1	1520
1200	0.647	37.4	1700
1300	0.665	38.4	1880
1400	0.680	39.3	2060
1500	0.691	39.9	2240
1600	0.699	40.4	2420
1700	0.704	40.7	2600
1800	(0.707)	(40.9)	2780
1900	(0.707)	(40.9)	2960
2000	(0.705)	(40.7)	3140
2200	(0.696)	(40.2)	3500
2400	(0.676)	(40.2)	3860
2600	(0.645)	(37.3)	4220
2800	(0.602)	(34.[illegible])	4580
3000	(0.543)	(31.4)	4940
3200	(0.467)	(27.0)	5300
3400	(0.383)	(22.1)	5660
3600	(0.293)	(16.9)	6020
3800	(0.193)	(11.2)	6380
4000	(0.086)	(4.97)	6740
4150	(0.002)	(0.12)	7010

REMARKS

The recommended values are for high-purity lithium with residual electrical resistivity $\rho_0 = 0.0371\ \mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, $\alpha' = 1.57 \times 10^{-4}$, and $\beta = 1.52$. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

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* T_1 in K, k_1 in Watt $cm^{-1}K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1}ft^{-1}F^{-1}$.

‡ Values in parentheses are extrapolated or estimated.

THERMAL CONDUCTIVITY OF LUTETIUM

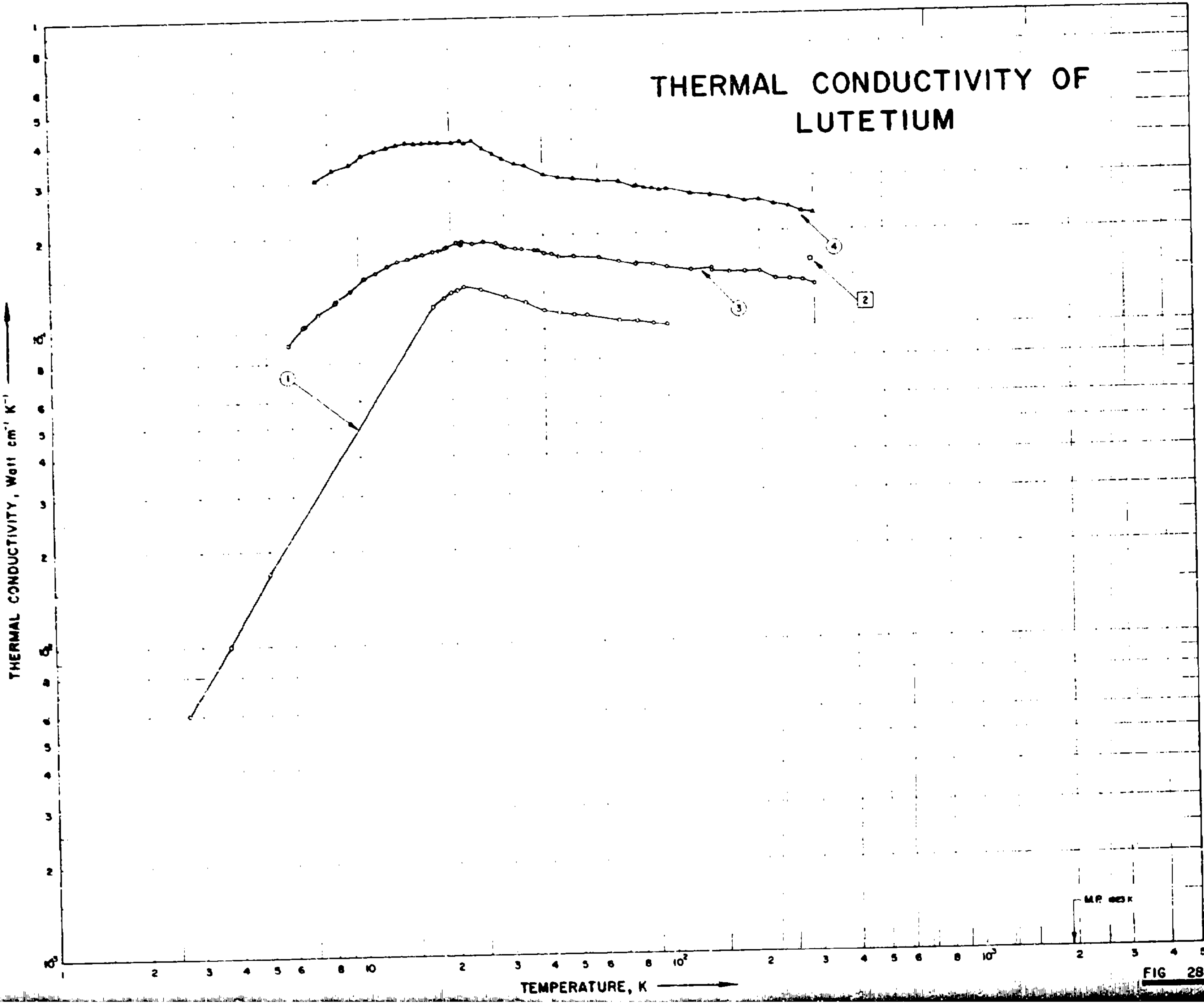


FIG 28

SPECIFICATION TABLE NO. 28 THERMAL CONDUCTIVITY OF LUTETIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 28]

Curve No.	Ref. No.	Method Used*	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	994, 820	L	1965	2.7-100			99.99 pure; polycrystalline; strip specimen 0.25 mm thick; annealed in stream of helium vapor at 600 C for 3 hrs; electrical resitivity reported at 4.2 and 293 K, respectively as 12.3 and 79 μohm cm; data from smoothed curve; Lorenz function reported as 3.40×10^{-8} $V^2 K^{-2}$ in the residual resistance region.
2	256	C	1966	291	±4		<0.1 rare earth metal; ~0.5 Ta, ~0.05 base metals; polycrystalline specimen 1.2 x 1.2 x 0.31 cm; electrical resistivity 59 μohm cm at 291 K; data proposed by the author from measurements of 2 different thermal comparators.
3	‡	L	1967	5.9-300	5-6		0.0600 Yb, <0.0200 Ta, 0.012 O, <0.0100 Er, <0.0100 Y, <0.0030 Fe, 0.0025 N, <0.0020 Ca, <0.0010 each of Al, Cr, Cu, Mg, Ni, Si, and Tm, and <0.0005 Sc; single crystal; 8.18 x 1.53 x 1.40 cm; grown from arc-melted buttons using the strain anneal method; <10$\bar{1}$0> direction (b-axis) along the specimen axis; electrical resistivity reported as 2.650, 2.650, 2.652, 2.652, 2.663, 2.703, 2.924, 3.313, 4.103, 5.818, 9.089, 12.981, 18.864, 22.779, 28.478, 36.422, 44.358, 52.232, 62.593, and 76.517 μohm cm at 1.3, 2.4, 3.3, 4.2, 7.0, 9.9, 14.6, 18.8, 24.0, 32.4, 44.4, 57.5, 77.5, 90.5, 111.0, 139.7, 169.6, 199.9, 240.3, and 297.5 K, respectively; electrical resistivity ratio $\rho_{300K}/\rho_{4.2K}$ = 28.9; residual electrical resistivity 2.65 μohm cm; Lorenz function reported as 4.31, 3.46, 3.33, 3.44, 3.70, 3.89, 4.00, 4.00, 3.93, 3.77, 3.60, and 3.52×10^{-8} $V^2 K^{-2}$ at 5.5, 14.7, 21.4, 30.1, 45.4, 67.4, 97.8, 114.6, 150.2, 207.3, 267.1, and 300.0 K, respectively; heat flow along b-axis.
4	‡	L	1967	7.3-299			0.0200 Tm, <0.0200 Ta, <0.0200 Ti, <0.0100 W, <0.0100 Y, 0.0099 O, <0.0030 Fe, <0.0010 each of Al, Ca, Cr, Cu, Er, Mg, Ni, and Sc, 0.0008 N, <0.0005 Sc, and <0.0005 Yb; single crystal; 17.96 x 2.18 x 2.14 mm; grown from arc-melted buttons using the strain anneal method; <0001> direction along the specimen axis; electrical resistivity reported as 0.759, 0.759, 0.761, 0.761, 0.770, 0.798, 0.852, 0.941, 1.069, 1.374, 1.842, 2.861, 4.709, 6.253, 8.630, 11.811, 15.178, 18.849, 21.581, 26.250, and 34.793 μohm cm at 1.2, 2.4, 3.3, 4.2, 7.0, 10.0, 13.0, 16.0, 19.0, 24.0, 30.0, 40.6, 56.1, 70.3, 92.6, 120.8, 150.0, 180.0, 200.8, 240.0, and 298.6 K, respectively; electrical resistivity ratio $\rho_{300K}/\rho_{4.2K}$ = 45.7; residual electrical resistivity 0.76 μohm cm; Lorenz function reported as 3.37, 2.66, 2.33, 2.22, 2.19, 2.26, 2.46, 2.56, 2.58, 2.61, and 2.61×10^{-8} $V^2 K^{-2}$ at 5.5, 12.2, 18.4, 24.8, 30.7, 45.2, 58.9, 68.1, 77.6, 158.3, and 300.0 K, respectively; heat flow along c-axis.

‡Boys, D.W. and Legvold, S., "Thermal Conductivities and Lorenz Functions of Dy, Er, and Lu Single Crystals," to be published in Physical Review; also USAEC IS-T-185, 1967.

DATA TABLE NO. 28 THERMAL CONDUCTIVITY OF LUTETIUM

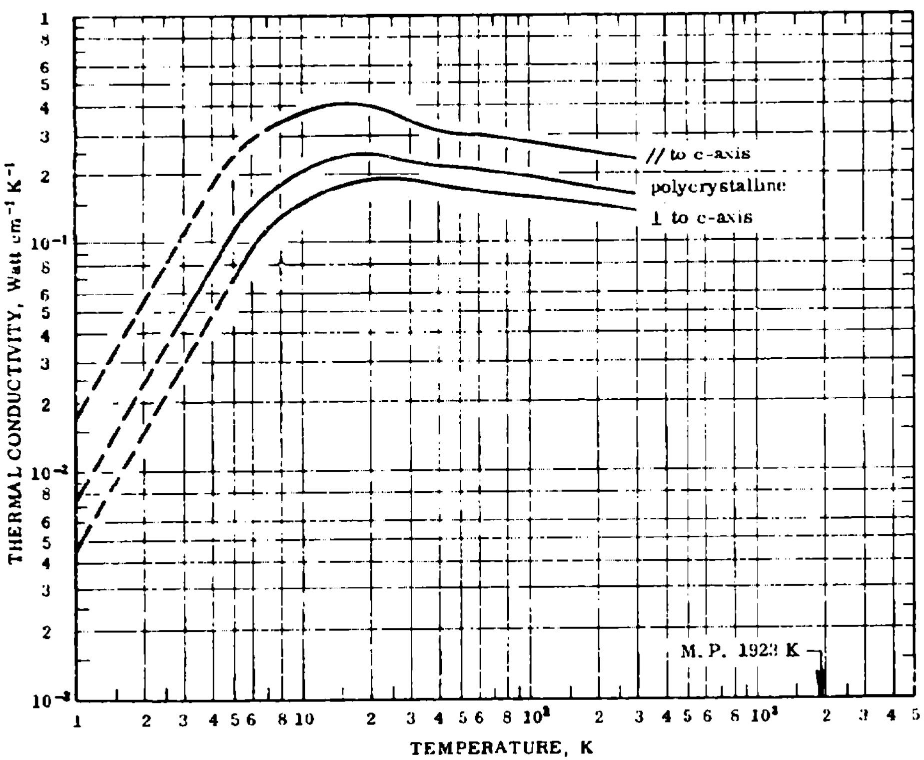
(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
2.7	0.006
3.7	0.010
5.0	0.017
17.5	0.120
19.0	0.127
20.0	0.133
21.0	0.135
22.0	0.137
25.0	0.135
30.0	0.127
35.0	0.122
40.0	0.115
45.0	0.113
50.0	0.111
55.0	0.110
70.0	0.106
80.0	0.105
90.0	0.103
100.0	0.102
CURVE 2	
291	0.162
CURVE 3	
5.9	0.092
6.6	0.105
6.7	0.106
7.4	0.116
8.4	0.127
8.4	0.126
9.4	0.137
10.5	0.149
11.4	0.156
12.5	0.163
13.4	0.168
14.5	0.172
15.4	0.175
16.2	0.177
17.5	0.180
18.4	0.182
CURVE 3 (cont.)	
19.2	0.185
19.4	0.186
20.8	0.193
21.3	0.192
21.6	0.189
21.7	0.193
23.5	0.190
25.6	0.193
28.1	0.191
29.3	0.187
30.0	0.185
32.4	0.183
34.0	0.182
37.3	0.180
38.3	0.179
40.0	0.176
42.5	0.174
44.8	0.172
50.0	0.172
60.1	0.169
70.0	0.164
79.3	0.160
79.5	0.161
90.6	0.159
100.0	0.157
120.3	0.153
140.2	0.154
140.2	0.152
159.8	0.149
179.8	0.149
200.0	0.149
225.0	0.142
250.0	0.141
275.1	0.139
300.0	0.136
CURVE 4	
7.3	0.307
8.3	0.332
9.4	0.344
10.3	0.367
CURVE 4 (cont.)	
11.4	0.378
12.5	0.389
13.4	0.395
14.4	0.399
15.4	0.397
16.4	0.399
17.5	0.399
18.5	0.399
20.3	0.398
20.4	0.399*
21.7	0.404
22.4	0.397
23.6	0.405
25.5	0.383
27.2	0.366
29.7	0.354
32.5	0.339
35.0	0.334
40.3	0.313
45.0	0.311
50.0	0.302
60.3	0.296
70.3	0.294
79.3	0.283
80.4	0.284
85.4	0.279
90.3	0.278
95.3	0.274
100.3	0.277
120.0	0.266
139.7	0.263
160.1	0.257
180.0	0.249
200.1	0.252
224.8	0.243
250.1	0.238
275.1	0.230
299.4	0.227

* Not shown on plot

FIGURE AND TABLE NO. 28R   RECOMMENDED THERMAL CONDUCTIVITY OF LUTETIUM



RECOMMENDED VALUES*

T_1	(// to c-axis) k_1	(// to c-axis) k_2	(⊥ to c-axis) k_1	(⊥ to c-axis) k_2	(Polycrystalline) k_1	(Polycrystalline) k_2	T_2
0	0	0	0	0	0	0	-459.7
1	(0.0156)‡	(0.901)	(0.00515)	(0.298)	(0.00746)	(0.431)	-457.9
2	(0.0500)	(2.89)	(0.0167)	(0.965)	(0.0240)	(1.39)	-456.1
3	(0.0993)	(5.74)	(0.0330)	(1.91)	0.0476	2.75	-454.3
4	(0.162)	(9.36)	(0.0538)	(3.11)	0.0772	4.46	-452.5
5	(0.218)	(12.6)	(0.0748)	(4.32)	0.107	6.18	-450.7
6	(0.263)	(15.2)	0.0940	5.43	0.133	7.68	-448.9
7	(0.296)	(17.1)	0.111	6.41	0.154	8.90	-447.1
8	0.323	18.7	0.125	7.22	0.172	9.94	-445.3
9	0.344	19.9	0.136	7.86	0.186	10.7	-443.5
10	0.360	20.8	0.146	8.44	0.198	11.4	-441.7
11	0.373	21.6	0.154	8.90	0.207	12.0	-439.9
12	0.383	22.1	0.161	9.30	0.216	12.5	-438.1
13	0.391	22.6	0.167	9.65	0.222	12.8	-436.3
14	0.398	23.0	0.172	9.94	0.228	13.2	-434.5
15	0.403	23.3	0.176	10.2	0.233	13.5	-432.7
16	0.406	23.5	0.179	10.3	0.236	13.6	-430.9
18	0.408	23.6	0.185	10.7	0.241	13.9	-427.3
20	0.405	23.4	0.188	10.9	0.243	14.0	-423.7
25	0.382	22.1	0.191	11.0	0.238	13.8	-414.7
30	0.351	20.3	0.188	10.9	0.229	13.2	-405.7
35	0.329	19.0	0.182	10.5	0.222	12.8	-396.7
40	0.317	18.3	0.178	10.3	0.217	12.5	-387.7
45	0.308	17.8	0.175	10.1	0.213	12.3	-378.7
50	0.303	17.5	0.173	10.0	0.209	12.1	-369.7
60	0.296	17.1	0.169	9.76	0.204	11.8	-351.7
70	0.290	16.8	0.166	9.59	0.199	11.5	-333.7
80	0.285	16.5	0.163	9.42	0.196	11.3	-315.7
90	0.280	16.2	0.161	9.30	0.192	11.1	-297.7
100	0.276	15.9	0.159	9.19	0.189	10.9	-279.7
150	0.261	15.1	0.152	8.78	0.179	10.3	-189.7
200	0.249	14.4	0.147	8.49	0.172	9.94	- 99.7
250	0.240	13.9	0.142	8.20	0.166	9.59	- 9.7
273.2	0.236	13.6	0.140	8.09	0.164	9.48	32.0
300	0.232	13.4	0.138	7.97	0.162	9.36	80.3

REMARKS

The recommended values are for well-annealed 99.96⁺% pure lutetium with residual electrical resistivity ρ_0 = 0.8 and 2.7 $\mu\Omega$ cm respectively in the direction parallel and perpendicular to the c-axis (characterization by ρ_0 becomes important at temperatures below about 200 K). The recommended values that are supported by experimental data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

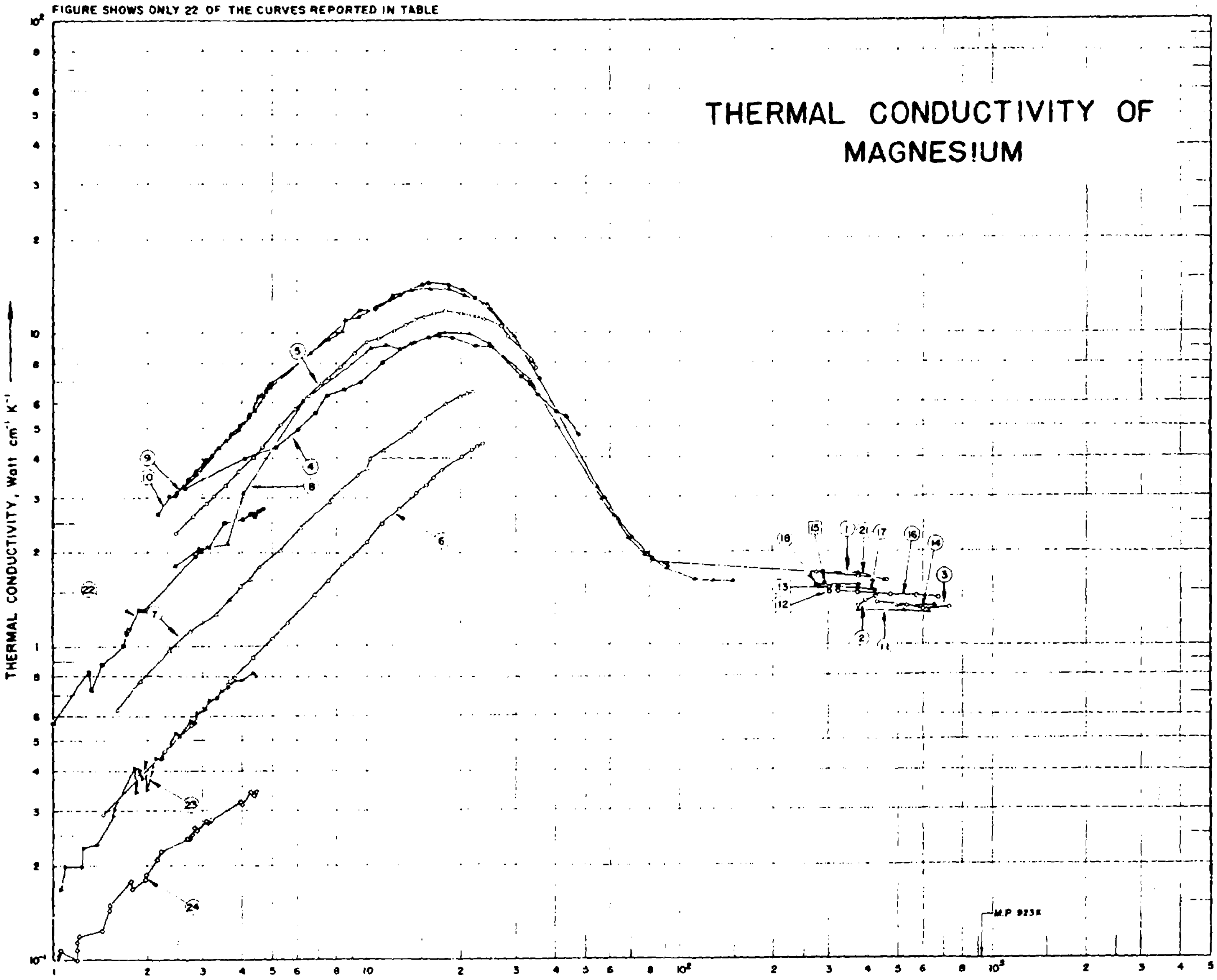


FIGURE SHOWS ONLY 22 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF MAGNESIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 923K

FIG 29

SPECIFICATION TABLE NO. 29 THERMAL CONDUCTIVITY OF MAGNESIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 29]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	850, 93	L	1929	80-460	3.0-4.0		Extremely pure; 3 cm x 1.23 cm^2; electrical resistivity reported as 0.32, 3.91, 5.56, and 7.27 μ ohm cm at 80, 273, 373, and 460 K, respectively.
2	53	E	1927	373-423	1.0		Commercially pure.
3	127	L	1925	430-729			99.6 pure; 0.75 in. rod; obtained from Magnesium Co., Ltd.; extruded, then annealed for 6 hrs at 360 C; density (at 21 C) 1.75 g cm^{-3}; electrical resistivity reported as 4.59, 6.19, 8.13, 10.35, 11.13, and 13.74 μohm cm at 20.0, 101.2, 199.4, 314.0, 348.3, and 480.1 C, respectively.
4	97	L	1952	2.6-47	2.0-3.0	JM 1703; Mg 1	99.95 pure; polycrystalline; 1-2 mm dia x 5 cm long; obtained from Johnson-Matthey.
5	121	L	1954	2.5-35	1.0	JM 1703; Mg 2	99.95+ Mg, 0.03 Mn, 0.0075 Fe, and 0.004 Al; 15 mm dia specimen made from Johnson Matthey standardized rod; annealed in vacuo at 500 C for 6 hrs.
6	137	L	1957	1.5-24	1.0	Mg (Mn)	99.95+ Mg, 0.043 Mn, 0.0048 Zn, 0.0012 Ca, 0.0011 Pb, 0.0011 Sn, 0.0010 Fe, 0.001 Si, 0.0002 Al, 0.0001 Cu, and 0.0001 Ni; polycrystalline; 3.2 mm dia x 9 cm long; prepared by Dow Chemical Co.; annealed; electrical resistivity reported as 0.1479, 0.1270, 0.1196, 0.1187, and 0.1217 μohm cm at 1, 5, 10, 14.5, and 20 K, respectively.
7	137	L	1957	1.6-22	1.0	Mg (Fe)	99.98+ Mg, 0.013 Fe, 0.0023 Mn, 0.0013 Pb, traces of Al, Ca, Cu, Si, Ag, and Na; polycrystalline; 3.2 mm dia x 9 cm long; prepared from a Johnson Matthey spectrographic rod; electrical resistivity reported as 0.06624, 0.06458, 0.0655, 0.0679, and 0.0727 μohm cm at 1, 5, 10, 15, and 20 K, respectively.
8	275	L	1953	2.5-91	0.5-1.0	JM 1348; Mg 1	99.98+ Mg, 0.013 Fe, 0.0023 Mn, 0.0013 Pb, traces of Ca, Cu, Si, Ag, and Na; 3 mm dia rod drawn by Johnson-Matthey from a sample JM 1848.
9	275	L	1953	2.5-149	0.5-1.0	JM 1848; Mg 2	The above specimen annealed in vacuo for 3 hrs at 350 C.
10	275	L	1953	2.2-27	0.5-1.0	JM 1848; Mg 3	Similar to the above specimen Mg 2.
11	225	L	1928	373-623			0.031 Si, 0.012 Cu, and 0.014 total Fe and Al; 1 in. dia x 12 in. long; annealed for 5 hrs at 530 C before machining.
12	408	E	1925	302.2	< 0.5	Mg	0.175 Si, 0.052 Al, and 0.014 Fe; 3 mm dia x 20 cm long; chill-cast; electrical resistivity 4.52 μohm cm at 29 C.
13	408	E	1925	301.2	< 0.5	Mg	The above specimen annealed for 30 min at 450 C; electrical resistivity 4.42 μohm cm at 29 C.
14	295		1952	493, 553			Extruded powder specimen; density 98-100% of theoretical value.
15	673	E	1932	291.3	± 1.3		Pure; electrical conductivity 2.31 x 10^5 $ohm^{-1}cm^{-1}$ at 18.1 C.
16	674	L, C	1964	323-673		Mg 1	99.95 Mg, 0.033 Al, and 0.012 Zn; 1.9 cm in dia and 30 cm long; supplied by the Metallurgy Division of the National Physical Laboratory; forged and stabilising heat treated; electrical resistivity reported as 4.5, 5.01, 5.85, 7.57, 9.30, and 11.04 μohm cm at 293, 323, 373, 473, 573, and 673 K, respectively.

SPECIFICATION TABLE NO. 29 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
17	674	L, C	1964	323-423		Mg II	99.96 Mg, 0.017 Al, and 0.004 Zn; 0.635 cm in dia and 10 cm long; supplied by Messrs. Johnson, Matthey & Co., Ltd.; electrical resistivity reported as 4.34, 4.85, 5.70, and 6.51 μ ohm cm at 293, 323, 373, and 423 K, respectively.
18	706	L	1881	273,373			Electrical conductivity reported as 24.47 and 17.5 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
19	719	P	1965	293.2			Spectroscopically pure; specimen 1.27 cm long; thermal conductivity values calculated from measured thermal diffusivity data.
20	719	P	1965	293.2			Similar to the above specimen but 0.635 cm long.
21	722	L	1963	307-324			Specimen 4.025 in. in dia and 1.015 in. thick.
22	721	L	1953	1.0-4.7		Sample # 765	99.98+ Mg, 0.01 Mn, 0.003 Zn, 0.0012 Pb, 0.001 Ca, <0.001 Si, <0.001 Sn, 0.0008 Fe, 0.0002 Al, < 0.0001 Cu, and < 0.0001 Ni; specimen 9.03 cm long and 0.319 cm in dia; electrical resistivity reported as 0.048, 0.042, 0.04, 0.037, 0.04, 0.042, 0.047, and 0.058 μ ohm cm at 1.0, 3.0, 5.0, 10.0, 15.0, 20.0, 25.0, and 30 K, respectively.
23	721	L	1953	1.1-4.4		Sample # 767	99.95 Mg, 0.043 Mn, 0.0048 Zn, 0.0012 Ca, 0.0011 Pb, 0.0011 Sn, 0.0010 Fe, < 0.001 Si, 0.0002 Al, < 0.0001 Cu, and < 0.0001 Ni; specimen 8.93 cm long and 0.307 cm in dia; electrical resistivity reported as 0.153, 0.144, 0.136, 0.123, 0.120, 0.127, and 0.137 μ ohm cm at 1.0, 3.0, 5.0, 10, 15, 20, and 25 K, respectively.
24	721	L	1953	1.0-4.5		Sample # 370	99.87+ Mg, 0.12 Mn, 0.0036 Zn, 0.0014 Pb, 0.0011 Fe, <0.001 Si, < 0.001 Sn, 0.0006 Ca, 0.0002 Al, < 0.0002 Ni, and 0.0001 Cu; specimen 9.35 cm long and 0.305 cm in dia; electrical resistivity reported as 0.365, 0.34, 0.32, 0.29, 0.275, 0.30, and 0.37 μ ohm cm at 1.0, 3.0, 5.0, 10, 20, 30, and 40 K, respectively.
25	843	P	1966	298.2			Spherical grains supplied by Valley Metallurgical Processing Co.; specimen contained in a 0.75 in. dia x 2 in. long cylindrical cell; mesh size -100 + 200; thermal conductivity measured by the transient line source method; measured in Freon - 12 under a pressure of ~100 psig.
26	843	P	1966	298.2			Similar to above; measured in argon under a pressure of ~100 psig.
27	843	P	1966	298.2			Similar to above; measured in nitrogen under a pressure of ~100 psig.
28	843	P	1966	298.2			Similar to above; measured in methane under a pressure of ~100 psig.
29	843	P	1966	298.2			Similar to above; measured in helium under a pressure of ~100 psig.
30	843	P	1966	298.2			Similar to above; measured in hydrogen under a pressure of ~100 psig.

DATA TABLE NO. 29 THERMAL CONDUCTIVITY OF MAGNESIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
80.0	1.870
273.0	1.720
373.0	1.665
460.0	1.628
CURVE 2	
373.2	1.339
393.2	1.381
423.2	1.423
CURVE 3	
429.9	1.372
532.8	1.331
599.2	1.293
729.4	1.314
CURVE 4	
2.63	3.211
4.08	4.000
5.13	4.316
6.05	4.947
6.84	5.580
7.50	6.316
8.48	6.580
9.53	6.947
11.31	8.080
13.94	9.211
15.78	9.632
17.10	9.737
18.87	9.605
22.36	9.053
25.38	8.947
31.17	7.263
33.14	6.842
35.37	6.316
40.30	5.580
43.40	5.395
47.34	4.737
CURVE 5	
2.47	2.318
2.80	2.605
3.08	2.872
3.25	3.026
3.54	3.280
3.92	3.650
4.38	4.020
4.67	4.145
5.33	5.125
5.92	5.764
6.58	6.295
7.17	6.890
7.58	7.200
8.25	7.800
9.17	8.610
10.08	9.310
10.83	9.536
12.25	10.130
13.42	10.650
14.33	11.015
15.37	11.330
16.42	11.585
17.96	11.810
20.08	11.610
21.67	11.485
22.50	11.425
23.83	11.125
26.92	10.560
28.33	9.720
33.58	8.240
34.75	7.730
CURVE 6	
1.45	0.292
2.27	0.462
2.77	0.563
3.65	0.770
4.35	0.923
5.00	1.055
5.60	1.185
CURVE 6 (cont.)	
6.32	1.460
7.58	1.615
8.40	1.830
8.95	1.945
10.00	2.155
11.15	2.460
12.73	2.755
14.40	3.090
15.50	3.280
16.35	3.460
17.40	3.660
20.08	4.030
21.60	4.230
22.55	4.340
23.50	4.430
CURVE 7	
1.60	0.631
1.96	0.770
2.35	0.970
2.73	1.108
3.32	1.262
3.65	1.415
3.95	1.555
4.25	1.640
4.55	1.785
5.30	2.030
6.15	2.390
7.60	2.890
7.85	3.015
9.32	3.520
10.00	3.729
10.25	3.970
11.35	4.230
13.40	4.860
15.45	5.310
17.80	5.900
19.85	6.230
20.80	6.355
21.75	6.460
CURVE 8	
2.46	1.80
2.94	2.06
3.60	2.14
4.05	3.10
6.28	6.01
10.43	8.87
11.59	9.05
12.86	8.79
14.84	9.24
17.84	9.93
21.40	9.87
24.90	9.14
33.40	7.05
56.40	2.97
61.30	2.61
68.50	2.21
77.50	1.96
91.40	1.81
CURVE 9	
2.49	3.100
2.61	3.250
2.86	3.550
3.23	4.080
3.59	4.520
3.91	4.920
4.22	5.390
4.54	6.240
4.92	6.810
6.61	8.560
7.59	9.420
8.40	10.06
8.55	11.00
9.47	11.18
10.75	12.03
11.92	12.69
12.16	13.01
13.98	13.59
16.00	13.77
18.40	13.75
CURVE 9 (cont.)	
20.53	13.10
24.06	12.34
29.6	9.68
35.7	7.13
40.0	5.57
54.5	3.21
57.3	3.00
63.6	2.53
70.4	2.22
81.2	1.91
90.85	1.78
111.9	1.64
129.3	1.62
149.3	1.61
CURVE 10	
2.175	2.650
2.356	3.014
2.470	3.048
2.716	3.406
2.886	3.629
3.103	3.895
3.397	4.295
3.733	4.741
3.957	5.035
4.284	5.483
4.408	5.659
4.725	6.202
4.799	6.475
4.927	6.639
9.50	11.80
10.73	11.82
12.85	13.17
15.04	14.18
15.80	14.31
18.31	14.19
20.33	13.73
22.19	12.89
25.0	11.85
27.3	10.65
CURVE 11	
373.2	1.297
523.2	1.297
623.2	1.255
CURVE 12	
302.2	1.481
CURVE 13	
301.2	1.531
CURVE 14	
493.2	1.35
653.2	1.33
CURVE 15	
291.3	1.598
CURVE 16	
323.2	1.49
373.2	1.48
473.2	1.46
573.2	1.45
673.2	1.43
CURVE 17	
323	1.54
373	1.52
423	1.50
CURVE 18	
273.2	1.573
373.2	1.573
CURVE 19*	
293.2	0.151
CURVE 20*	
293.2	0.150
CURVE 21*	
307.1	1.60
307.2	1.59
307.3	1.57
307.3	1.57
307.3	1.56
311.7	1.59
312.2	1.60
312.3	1.60
312.7	1.59
312.7	1.58
312.9	1.60
313.1	1.59
313.1	1.59
313.4	1.56
318.1	1.59
318.2	1.60
318.5	1.57
319.5	1.55
323.7	1.65
324.0	1.58
324.2	1.58
324.5	1.57
CURVE 22	
1.0	0.575
1.3	0.825
1.33	0.725
1.43	0.875
1.68	1.03
1.73	1.10
1.75	1.15
1.88	1.30
CURVE 22 (cont.)	
1.95	1.30
2.85	1.93
2.93	2.00
3.13	2.13
3.53	2.48
4.03	2.55
4.23	2.65
4.40	2.60
4.43	2.63
4.53	2.70
4.68	2.75
CURVE 23	
1.06	0.17
1.10	0.20
1.24	0.20
1.25	0.23
1.38	0.235
1.56	0.29
1.57	0.305
1.84	0.41
1.85	0.345
1.88	0.405
1.93	0.38
1.98	0.43
2.00	0.35
2.14	0.44
2.23	0.44
2.47	0.53
2.53	0.515
2.75	0.58
2.84	0.57
2.88	0.615
3.05	0.63
3.16	0.67
3.34	0.68
3.43	0.715
3.63	0.735
3.80	0.775
3.98	0.79

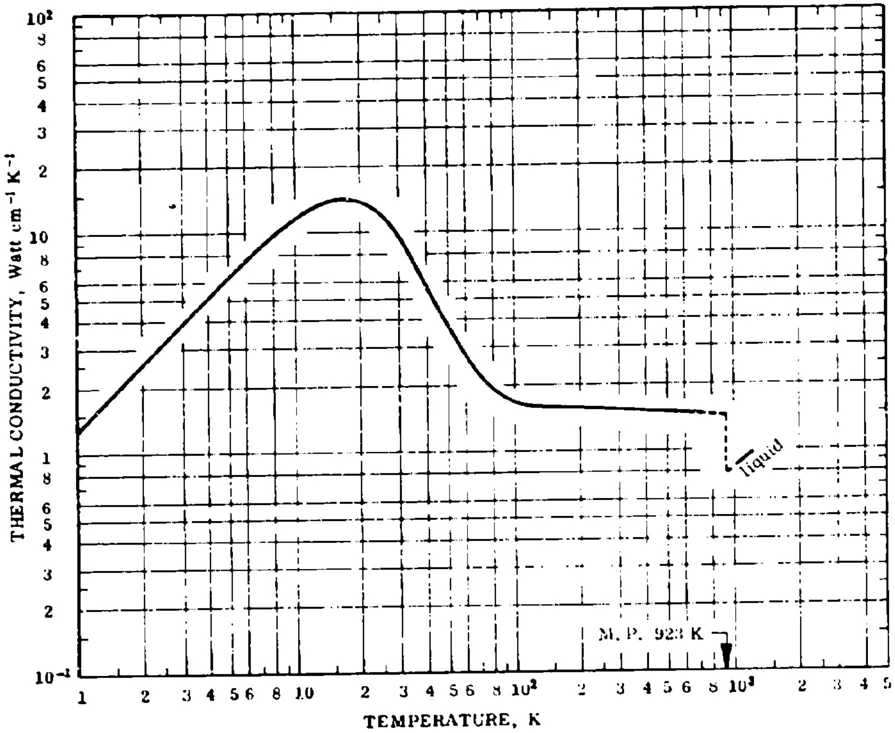
* Not shown on plot

DATA TABLE NO. 29 (continued)

T	k	T	k
CURVE 23 (cont.)		**CURVE 27***	
4.34	0.82	298.2	0.00272
4.44	0.805	**CURVE 28***	
CURVE 24		298.2	0.00406
1.02	0.092	**CURVE 29***	
1.04	0.096	298.2	0.00112
1.06	0.108	**CURVE 30***	
1.20	0.100	298.2	0.0155
1.20	0.108		
1.20	0.115		
1.22	0.120		
1.45	0.125		
1.52	0.145		
1.53	0.150		
1.78	0.180		
1.80	0.170		
1.97	0.182		
1.99	0.188		
2.16	0.210		
2.22	0.223		
2.70	0.245		
2.74	0.245		
2.77	0.252		
2.85	0.265		
2.90	0.260		
3.10	0.278		
3.13	0.275		
3.97	0.320		
4.02	0.315		
4.22	0.33		
4.30	0.345		
4.39	0.335		
4.48	0.345		
CURVE 25*			
298.2	0.00100		
CURVE 26*			
298.2	0.00269		

*Not shown on plot

FIGURE AND TABLE NO. 29R RECOMMENDED THERMAL CONDUCTIVITY OF MAGNESIUM



REMARKS

The recommended values for well-annealed 99.98$^+$% pure magnesium with residual electrical resistivity ρ_0 = 0.0189 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, α' = 0.83 x 10^{-4}, and β = 0.772. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature, and 3 to 10% at other temperatures.

RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	1.30	75.1	-457.9
2	2.59	150	-456.1
3	3.88	224	-454.3
4	5.15	298	-452.5
5	6.39	369	-450.7
6	7.60	439	-448.9
7	8.75	506	-447.1
8	9.83	568	-445.3
9	10.8	624	-443.5
10	11.7	676	-441.7
11	12.5	722	-439.9
12	13.1	757	-438.1
13	13.6	786	-436.3
14	14.0	809	-434.5
15	14.3	826	-432.7
16	14.4	832	-430.9
18	14.3	826	-427.3
20	13.9	803	-423.7
25	12.0	693	-414.7
30	9.5	549	-405.7
35	7.4	428	-396.7
40	5.7	329	-387.7
45	4.57	264	-378.7
50	3.75	217	-369.7
60	2.74	158	-351.7
70	2.23	129	-333.7
80	1.95	113	-315.7
90	1.78	103	-297.7
100	1.69	97.6	-279.7
150	1.61	93.0	-189.7
200	1.59	91.9	-99.7
250	1.57	90.7	-9.7
273.2	1.57	90.7	32.0
300	1.56	90.1	80.3
350	1.55	89.6	170.3
400	1.53	88.4	260.3

T_1	k_1	k_2	T_2
500	1.51	87.2	440.3
600	1.49	86.1	620.3
700	1.47	84.9	800.3
800	(1.46)‡	(84.4)	980.3
900	(1.45)	(83.8)	1160
923	(1.45)	(83.8)	1202
In Liquid State			
923	(0.79)	(45.6)	1202
1000	0.84	48.5	1340
1100	0.91	52.6	1520
1200	0.98	56.6	1700

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

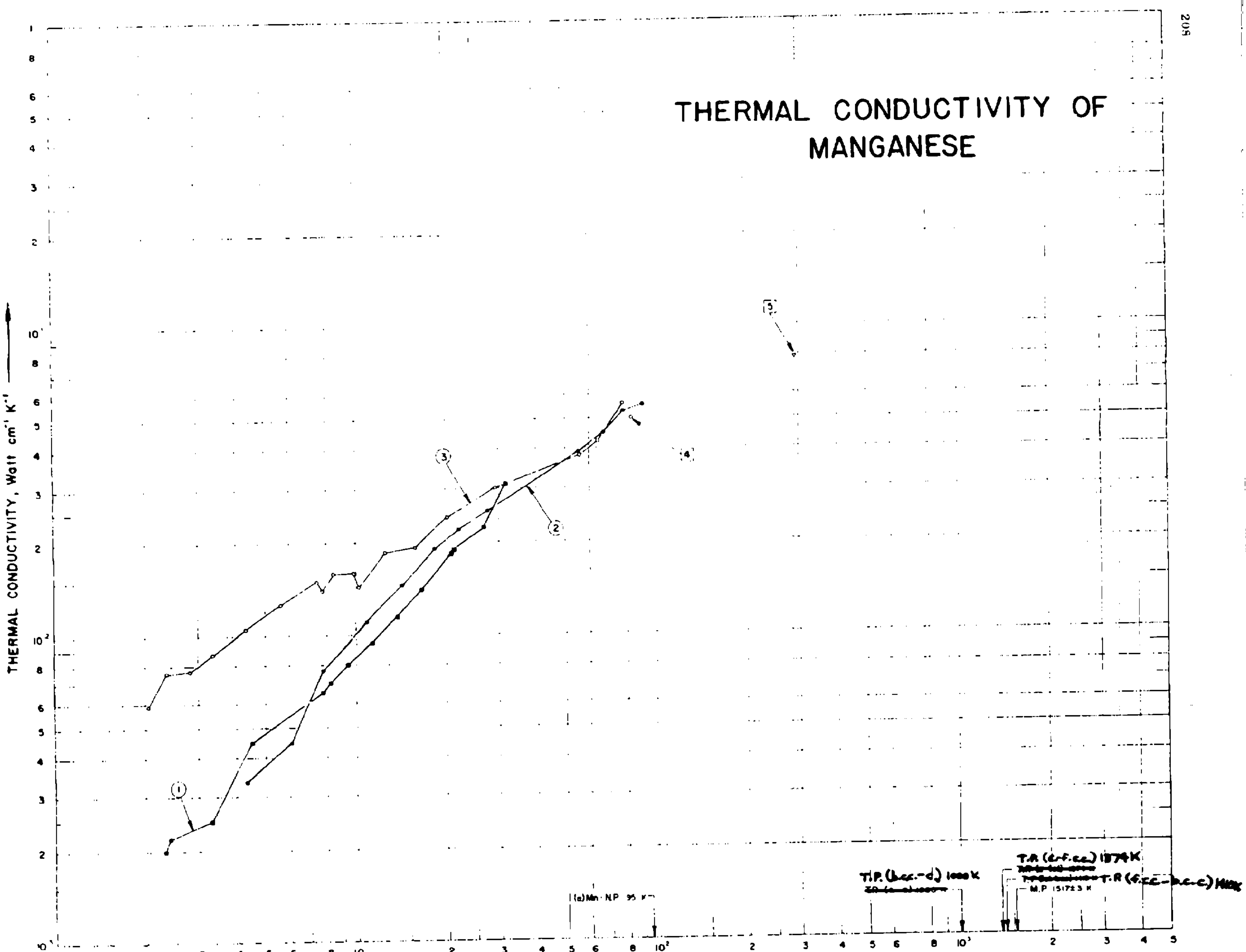

THERMAL CONDUCTIVITY OF MANGANESE
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
4
5
T.P. (b.c.c.–d.) 1000 K
T.R (c-f.c.c.) 1374 K
T.R (f.c.c.–b.c.c.) 1410K
M.P 1517±3 K
(α)Mn: N.P 95 K

FIG 30

SPECIFICATION TABLE NO. 30 THERMAL CONDUCTIVITY OF MANGANESE

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 30]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	97	L	1952	2.3-32	2-3	JM 2472; Mn 1	99.99 pure; polycrystalline; supplied by Johnson Matthey and Co. Ltd.; annealed; electrical resistivity ratio $\rho(273K)/\rho(20K) = 1.47$.
2	372	L	1957	4.3-9.		Mn 2	99.99 Mn, 0.001 Mg; α - manganese, cross section 3 x 1.1 mm; JM 10792 from Johnson, Matthey Co. Ltd.; electrical resistivity reported as 330 and 378 μ ohm cm at 4.2 K and room temperature, respectively.
3	372	L	1957	2.1-78		Mn 3	Similar to the above specimen except annealed in vacuum at 600 C; electrical resistivity 150 μ ohm cm at room temperature; residual electrical resistivity 11.3 μ ohm cm.
4	697	L	1935	83.2			β-manganese; approx 16 mm long, 5 mm dia; electrical resistivity 110 μ ohm cm at -190 C.
5	255	C	1966	293		JM 810	Pure α - manganese with impurities Mg, Ca, and < 0.01 S; some gaseous impurity expected; specimen a small irregular-shaped flake ~0.1 cm thick from Johnson Matthey and Co. Ltd.; electrolytically prepared; high-alloy steel, titanium alloy, and an alumina based ceramic used as reference materials.

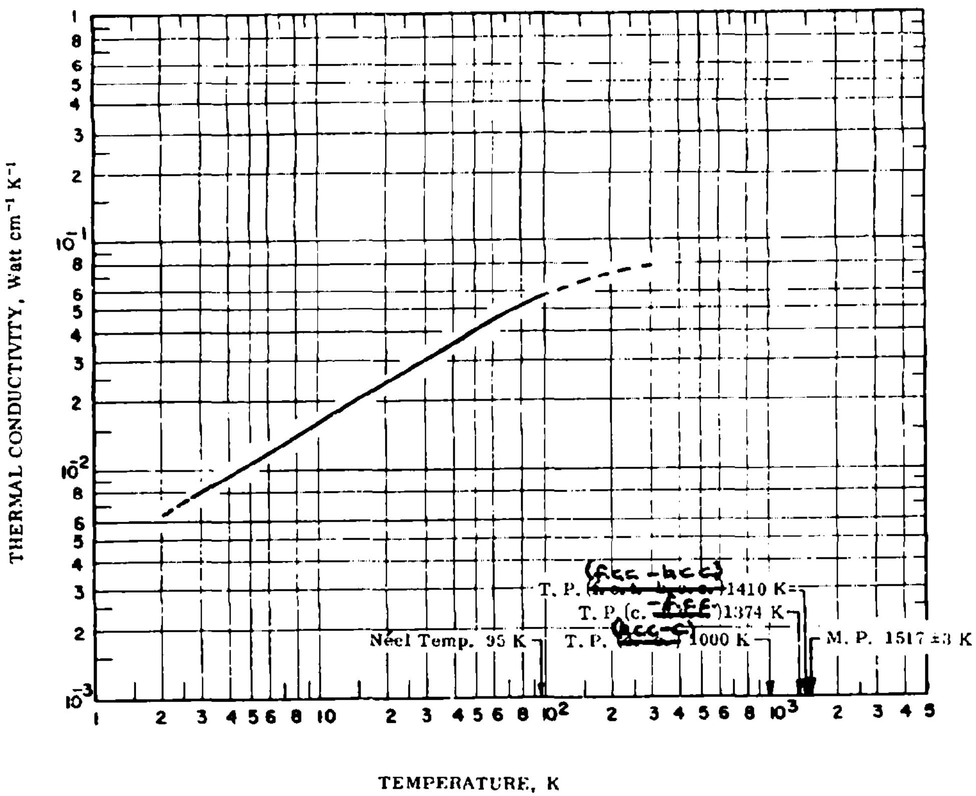
DATA TABLE NO. 30 THERMAL CONDUCTIVITY OF MANGANESE

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
2.3	0.0020
2.4	0.0022
3.3	0.0025
4.5	0.0045
7.7	0.0065
8.2	0.007
9.4	0.008
11.3	0.0095
13.8	0.0115
16.7	0.014
20.9	0.0185
21.4	0.019
26.9	0.022
31.8	0.031
CURVE 2	
4.31	0.00335
6.09	0.00448
7.97	0.00772
10.9	0.0111
14.3	0.0147
18.4	0.0191
22.2	0.022
27.6	0.0253
55.7	0.039
67.5	0.045
78.0	0.053
90.5	0.055
CURVE 3	
2.05	0.0059
2.37	0.0076
2.82	0.0077
3.37	0.00876
4.32	0.0106
5.66	0.0126
7.42	0.0151
7.77	0.0141
8.43	0.0158
9.85	0.0160
10.28	0.0144
CURVE 3 (cont.)	
12.71	0.0186
15.9	0.0193
20.3	0.0241
29.3	0.0302
55.9	0.038
64.2	0.042
78.0	0.056
CURVE 4	
83.2	0.05
CURVE 5	
293.0	0.078

FIGURE AND TABLE NO. 30R   RECOMMENDED THERMAL CONDUCTIVITY OF MANGANESE



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
2	(0.00645)‡	(0.373)	-456.1
3	0.00813	0.470	-454.3
4	0.00956	0.552	-452.5
5	0.0109	0.630	-450.7
6	0.0121	0.699	-448.9
7	0.0132	0.763	-447.1
8	0.0143	0.826	-445.3
9	0.0153	0.884	-443.5
10	0.0163	0.942	-441.7
11	0.0172	0.994	-439.9
12	0.0180	1.04	-438.1
13	0.0188	1.09	-436.3
14	0.0196	1.13	-434.5
15	0.0205	1.18	-432.7
16	0.0213	1.23	-430.9
18	0.0227	1.31	-427.3
20	0.0241	1.39	-423.7
25	0.0274	1.58	-414.7
30	0.0304	1.76	-405.7
35	0.0332	1.92	-396.7
40	0.0358	2.07	-387.7
45	0.0382	2.21	-378.7
50	0.0406	2.35	-369.7
60	0.0450	2.60	-351.7
70	0.0491	2.84	-333.7
80	0.0526	3.04	-315.7
90	0.0555	3.21	-297.7
100	(0.0579)	(3.35)	-279.7
150	(0.0664)	(3.84)	-189.7
200	(0.0717)	(4.14)	- 99.7
250	(0.0754)	(4.36)	- 9.7
273.2	(0.0768)	(4.44)	32.0
300	(0.0782)	(4.52)	80.3

REMARKS

The recommended values are for well-annealed 99.99% pure manganese with residual electrical resistivity ρ_0 = 11.3 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or interpolated.

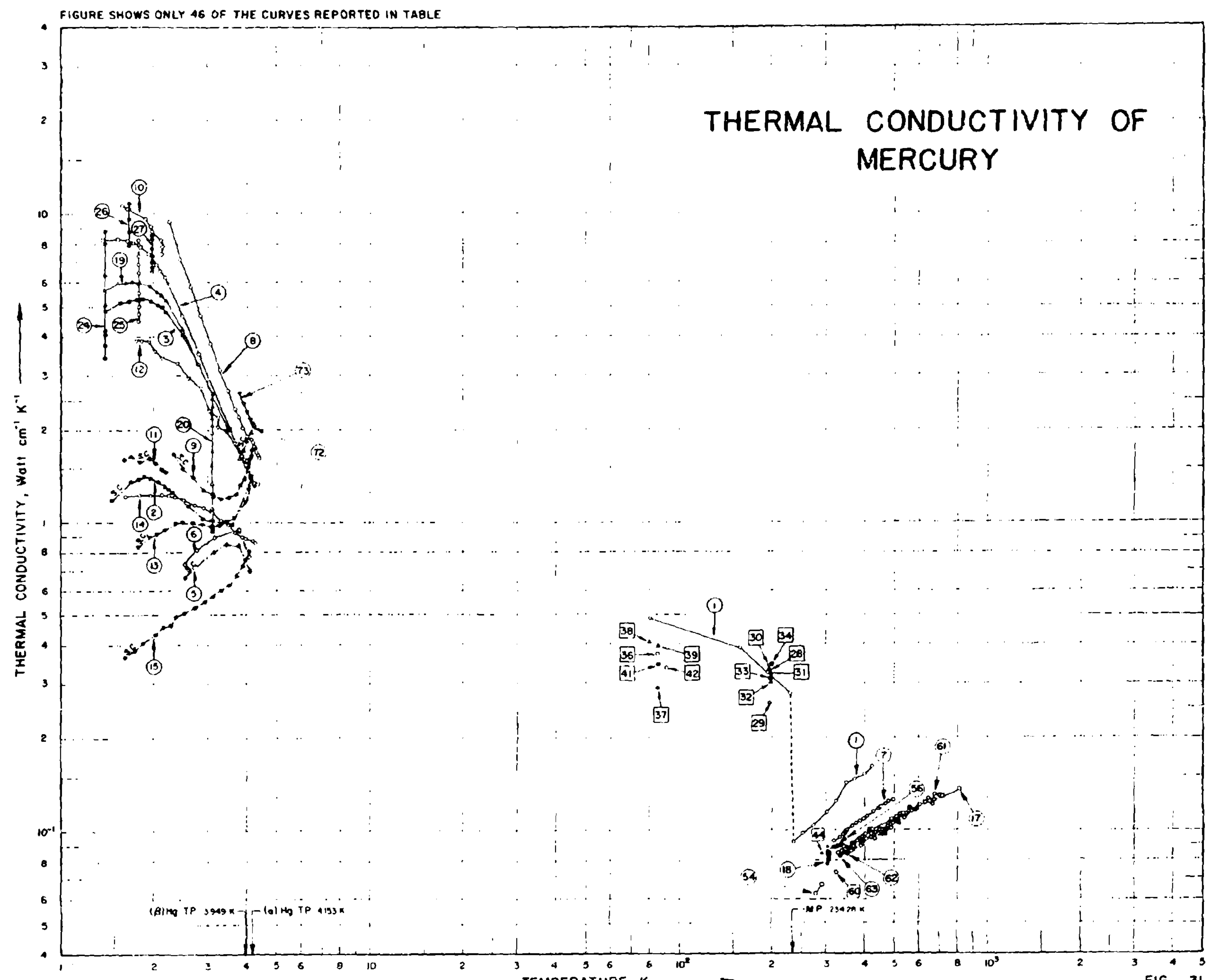


FIGURE SHOWS ONLY 46 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF MERCURY
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
(β) Hg TP 3.949 K
(α) Hg TP 4.153 K
MP 234.28 K

FIG 31

SPECIFICATION TABLE NO. 31 THERMAL CONDUCTIVITY OF MERCURY

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 31]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	50	L	1919	80-423			Pure; specimen filled in an iron cylinder; electrical conductivity reported as 13.77, 7.292, 5.327, 4.287, 1.070, and 1.055 x 10^4 $ohm^{-1}cm^{-1}$ at -193, -115, -75.1, -44.7, -37, and -20.5 C, respectively.
2	143	L	1957	1.5-4.1		Hg 3	99.9 Hg, 0.05 Cu, 0.05 Ag, and trace of other base elements; polycrystalline; commercially available cp reagent from Eimer and Amend, Cat. No. M-141; in superconducting state.
3	143	L	1957	1.4-3.5		Hg 3	The above specimen measured in a transverse magnetic field of 859 gauss; in normal state.
4	143	L	1957	1.4-4.4		Hg 3	The above specimen measured in a transverse magnetic field of 491 gauss; in normal state.
5	59	L	1936	2.5-4.1			High purity; specimen contained in an U-shaped tube; in superconducting state.
6	59	L	1936	2.5-4.1			The above specimen measured in a magnetic field of 436 gauss; in normal state.
7	316, 65	L	1936	318-492			Pure, specimen contained in a 4.9 cm dia asbestos cylinder.
8	74	L	1950	2.3-4.4		Hg 1	99.99^+ pure; in normal state.
9	74	L	1950	2.3-4.2		Hg 1	99.99^+ pure; in superconducting state.
10	74	L	1950	1.6-2.1		Hg 2	0.002 Cd; in normal state.
11	74	L	1950	1.6-2.2		Hg 2	0.002 Cd; in superconducting state.
12	74	L	1950	1.8-4.2		Hg 3	0.007 Cd; in normal state.
13	74	L	1950	1.8-4.0		Hg 3	0.007 Cd; in superconducting state.
14	74	L	1950	1.6-4.3		Hg 6	0.10 In; in normal state.
15	74	L	1950	1.6-4.1		Hg 6	0.10 In; in superconducting state.
16	657	P	1926	298			Liquid specimen contained in a cylindrical tube of 4 cm dia and 20 cm long; thermal conductivity value calculated from measured thermal diffusivity.
17	265	L	1955	426-810	1.4		99.999^+ Hg, 0.0001-0.001 Mg; chemical analysis after experiment showed 0.0004 Fe, 0.0002 Cr, and 0.0001 Ni; Lorentz function reported as 2.64, 2.59, 2.61, 2.63, and 2.64 x 10^{-8} V^2K^{-2} at 100, 184, 256, 288, and 297 C, respectively.
18	258	L	1903	303-308			Pure, specimen filled in a container of cross sectional area 315 cm^2 and thickness 0.955 cm.
19	143	L	1957	1.4-4.2		Hg 3	99.9 Hg, 0.05 Cu, 0.05 Ag, and trace of other base elements; commercially available cp reagent from Eimer and Amend, Cat. No. M-141; measured in a magnetic field of 737 gauss; in normal state.
20	143	L	1957	3.1		Hg 1	99.99^+ Hg, 0.005 Ag, and trace Cu; commercially available cp reagent from Eimer and Amend, Cat. No. M-141; measured in transverse magnetic fields with strength H ranging from 8.4 to 190 gauss; in superconducting state.
21	143	L	1957	3.1		Hg 1	The above specimen measured in transverse magnetic fields with strength H ranging from 247 to 974 gauss; in normal state.

SPECIFICATION TABLE NO. 31 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
22	143	L	1957	3.1		Hg 1	The above specimen measured in longitudinal magnetic fields with strength H ranging from 139 to 198 gauss; in superconducting state.
23	143	L	1957	3.1		Hg 1	The above specimen measured in longitudinal magnetic fields with strength H ranging from 284 to 727 gauss; in normal state.
24	143	L	1957	1.4		Hg 2	99.995% Hg, trace Ag; commercially available cp reagent from Eimer and Amend, Cat. No. M-141; measured in transverse magnetic fields with strength H ranging from 455 to 965 gauss; in normal state.
25	143	L	1957	1.8		Hg 2	The above specimen measured in transverse magnetic fields with strength H ranging from 460 to 1000 gauss; in normal state.
26	143	L	1957	1.67		Hg 2	The above specimen measured in longitudinal magnetic fields with strength H ranging from 455 to 965 gauss; in normal state.
27	143	L	1957	1.98		Hg 2	The above specimen measured in longitudinal magnetic fields with strength H ranging from 440 to 943 gauss; in normal state.
28	254	L	1932	196.2		7	Single crystal; the angle between principal crystallographic axis and rod axis 9 - 21°, grown in a glass [illegible]; electrical resistivity 15.15 μohm cm at 196.2 K.
29	254	L	1932	196.4		22	Similar to above but θ = 90° and electrical resistivity 19.30 μohm cm at 196.4 K.
30	254	L	1932	196.8		23	Similar to above but θ = [illegible]° and electrical resistivity 14.58 μohm cm at 196.9 K.
31	254	L	1932	197.5		26	Similar to above but θ = 28° and electrical resistivity 15.72 μohm cm at 197.5 K.
32	254	L	1932	197.6		27	Similar to above but θ = 46° and electrical resistivity 17.15 μohm cm at 197.6 K.
33	254	L	1932	197.1		28	Similar to above but θ = 38° and electrical resistivity 16.41 μohm cm at 197.2 K.
34	254	L	1932	198.4		29	Similar to above but θ = 6° and electrical resistivity 14.74 μohm cm at 198.4 K.
35	254	L	1932	197.3		30	Similar to above but θ = 0° and electrical resistivity 14.63 μohm cm at 197.3 K.
36	254	L	1932	85.2		3	Similar to above but θ = 25° and electrical resistivity 5.95 μohm cm at 85.2 K.
37	254	L	1932	85.4		22	Similar to above but θ = 90° and electrical resistivity 7.48 μohm cm at 85.4 K.
38	254	L	1932	90.2		23	Similar to above but θ = 0° and electrical resistivity 5.31 μohm cm at 90.3 K.
39	254	L	1932	85.5		24	Similar to above but θ = 8° and electrical resistivity 5.75 μohm cm at 85.5 K.
40	254	L	1932	85.5		26	Similar to above but θ = 28° and electrical resistivity 6.05 μohm cm at 85.6 K.
41	254	L	1932	86.6		27	Similar to above but θ = 46° and electrical resistivity 6.65 μohm cm at 86.6 K.
42	254	L	1932	90.6		28	Similar to above but θ = 46° and electrical resistivity 7.02 μohm cm at 90.5 K.
43	254	L	1932	86.2		30	Similar to above but θ = 0° and electrical resistivity 5.73 μohm cm at 86.2 K.

SPECIFICATION TABLE NO. 31 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
44	598	L	1913	290.5			In liquid state; measurement made on a flowing specimen at a rate of 871 g per 15 min.
45	598	L	1913	288.2			In liquid state; measurement made on a flowing specimen at a rate of 1003 g per 15 min.
46	598	L	1913	289.0			In liquid state; measurement made on a flowing specimen at a rate of 1079 g per 15 min.
47	598	L	1913	290.7			In liquid state; measurement made on a flowing specimen at a rate of 1099 g per 15 min.
48	598	L	1913	288.2			In liquid state; measurement made on a flowing specimen at a rate of 1159 g per 15 min.
49	598	L	1913	288.2			In liquid state; measurement made on a flowing specimen at a rate of 1199 g per 15 min.
50	598	L	1913	287.2			In liquid state; measurement made on a flowing specimen at a rate of 1296 g per 15 min.
51	598	L	1913	288.7			In liquid state; measurement made on a flowing specimen at a rate of 1301 g per 15 min.
52	598	L	1913	288.7			In liquid state; measurement made on a flowing specimen at a rate of 1361 g per 15 min.
53	598	L	1913	288.7			In liquid state; measurement made on a flowing specimen at a rate of 1422 g per 15 min.
54	644	P	1880	278, 290			In liquid state; specimen filled in a cylindrical container; thermal conductivity values calculated from measured data of thermal diffusivity, specific heat, and density.
55	638	R	1959	567-717			Chemically pure mercury vapor.
56	639	C	1961	304-343			Triple distilled liquid mercury; contained in a thin-walled reservoir of 3.5 in. deep; electrical resistivity reported as 96.7, 98.6, 101.1, 103.5, 109.1 and 115.0 μohm cm at 30, 50, 75, 100, 150, and 200 C, respectively; first experiment with thermocouples welded on the steel wall of mercury reservoir; stainless steel No. 15 used as comparative material.
57	640	R	1889	476.2			In vapor state; contained in a glass tube of dia 18.2 mm; measured at pressures ranging from 3.0 to 10.3 mm Hg; measured by hot-wire method.
58	641	L	1915	313			In liquid state; contained in a cylindrical vessel of ~4.9 cm dia x 40 cm long.
59	642	L	1887	323			In liquid state; contained in a tube of 13.2 mm dia x 20 cm long.
60	643	P	1864	323.2			In liquid state; thermal conductivity calculated from measured thermal diffusivity.
61	637, 592	L	1958	328-700		1	In liquid state.
62	637, 592	L	1958	353-556		2	In liquid state.
63	637, 592	L	1958	333-560		3	In liquid state.
64	639	C	1961	307-351			Triple distilled liquid mercury; contained in a thin-walled reservoir of 3.5 in. deep; electrical resistivity reported as 96.7, 98.6, 101.1, 103.5, 109.1, and 115.0 μohm cm at 30, 50, 75, 100, 150, and 200 C, respectively; first experiment with thermocouple immersed in the mercury; stainless steel No. 15 used as comparative material.
65	639	C	1961	334.7			Second experiment of the above specimen with thermocouples welded on the steel wall of mercury reservoir, mercury and stainless steel in poor electrical contact.

SPECIFICATION TABLE NO. 31 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
66	639	C	1961	319-383			Second experiment of the above specimen with thermocouples immersed in the mercury.
67	639	C	1961	318-517			Third experiment of the above specimen with a honeycomb of mica inserted to subdivide the mercury column and with thermocouples welded on the steel wall of mercury reservoir.
68	639	C	1961	332-416			Third experiment of the above specimen with thermocouples immersed in the mercury.
69	639	C	1961	307-368			Fourth experiment of the above specimen with the mercury column still further subdivided by the insertion of 36 cellophane drinking straws and with thermocouples welded on the steel wall of mercury reservoir.
70	639	C	1961	326-514			Measurement made on new mercury specimen after having the test apparatus thoroughly cleaned with new thermocouples welded on the steel wall of the mercury reservoir, a honeycomb of mica also being inserted to subdivide mercury column.
71	639	L	1961	304, 333			Similar to the above specimen but measured by guarded hot-plate method.
72	693	L	1963	3.8-4.2			Very pure; crystallized from triple distilled Hg; cylindrical specimen; cast in liquid air; in super conducting state.
73	693	L	1963	3.8-4.2			The above specimen measured in a magnetic field of 600 gauss; in normal state.
74	693	L	1963	3.8-4.2			The above specimen measured in a magnetic field of 800 gauss; in normal state.
75	316	L	1936	373-412	< 3	Amalgam; 1	0.10% Na; liquid specimen contained in a hollow asbestos cylinder; prepared by melting (under paraffin) appropriate amounts of certified pure Hg (from Mallinckrodt Chemical Co.) and Na (from Chemistry Department of Univ. of Kansas) in furnace, the liquid then kept at 150 C for 12 hrs.

DATA TABLE NO. 31 THERMAL CONDUCTIVITY OF MERCURY

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watts cm^{-1} K^{-1}]

CURVE 1

T	k
80.2	0.485
157.7	0.389
194.8	0.325
229.0	0.278
230.0	0.0912
252.5	0.0975
273.2	0.104
300.2	0.115
323.6	0.125
349.8	0.143
373.1	0.146
399.1	0.152
422.6	0.161

CURVE 2

T	k
1.46	1.18
1.69	1.35
1.78	1.37
1.86	1.40
1.95	1.39
2.06	1.35
2.17	1.31
2.23	1.28
2.28	1.26
2.59	1.14
2.89	1.03
3.59	0.98
4.13	1.40

CURVE 3

T	k
1.40	4.85
1.56	5.18
1.67	5.26
1.77	5.31
1.85	5.32
1.96	5.24
2.06	5.07
2.13	5.00
2.19	4.81
2.48	4.05
2.79	3.26
3.49	2.00

CURVE 4

T	k
1.37	8.28
1.53	8.32
1.65	8.26
1.72	8.1[illegible]
1.82	7.84
1.93	7.42
2.05	6.86
2.10	6.54
2.18	6.25
2.48	4.68
2.80	3.50
3.50	2.00
4.23	1.34
4.35	1.32

CURVE 5

T	k
2.51	0.667
3.14	0.800
3.45	0.847
3.76	0.840
4.07	0.699

CURVE 6

T	k
2.51	0.735
2.76	0.813
3.15	0.893
3.76	0.943
4.07	0.775

CURVE 7

T	k
318.1	0.0927
330.9	0.0950
340.1	0.0973
345.8	0.0991
345.4	0.0992
347.9	0.0999
352.1	0.101
364.4	0.104
375.8	0.106
386.1	0.108
398.0	0.110

CURVE 7 (cont.)

T	k
407.7	0.112
426.8	0.116
441.2	0.118
448.5	0.119
466.5	0.123
475.3	0.125
492.3	0.126

CURVE 8

T	k
2.25	9.48
2.44	7.13
2.65	5.81
2.84	4.70
3.05	3.80
3.27	3.12
3.47	2.68
3.57	2.35
3.77	2.20
3.88	2.03
4.00	1.91
4.14	1.87
4.18	1.83
4.22	1.77
4.25	1.74
4.29	1.69
4.34	1.65
4.38	1.61

CURVE 9

T	k
2.31	1.67
2.48	1.50
2.68	1.40
2.88	1.28
3.09	1.25
3.29	1.20
3.49	1.21
3.69	1.24
3.80	1.32
3.91	1.38
4.01	1.51
4.05	1.55
4.09	1.60

CURVE 9 (cont.)

T	k
4.12	1.65
4.15	1.72

CURVE 10

T	k
1.58	10.7
1.65	10.4
1.88	9.67
1.96	9.17
1.97	8.81
2.12	8.29
2.14	7.88
2.12	7.42

CURVE 11

T	k
1.61	1.60
1.70	1.64
1.82	1.57
1.95	1.62
2.03	1.56
2.14	1.48
2.19	1.47

CURVE 12

T	k
1.76	3.89
1.83	3.88
1.93	3.85
2.02	3.59
2.13	3.41
2.39	3.28
2.60	2.95
2.84	2.74
3.04	2.30
3.23	2.19
3.23	2.05
3.45	1.99
3.65	1.81
3.84	1.64
3.93	1.59
4.04	1.51
4.14	1.41
4.24	1.34

CURVE 13

T	k
1.78	0.834
1.93	0.895
2.05	0.915
2.18	0.945
2.36	0.992
2.48	1.000
2.68	0.995
2.87	0.987
3.06	0.970
3.26	0.975
3.45	1.00
3.65	1.03
3.95	1.17
4.04	1.28

CURVE 14

T	k
1.61	1.22
1.80	1.24
1.95	1.24
2.12	1.24
2.23	1.23
2.34	1.22
2.49	1.19
2.70	1.14
2.90	1.12
3.09	1.08
3.30	1.02
3.48	0.982
3.67	0.927
3.86	0.895
3.96	0.887
4.16	0.870
4.26	0.855

CURVE 15

T	k
1.61	0.365
1.73	0.385
1.85	0.405
2.02	0.430
2.15	0.453
2.26	0.460
2.37	0.493

CURVE 15 (cont.)

T	k
2.51	0.505
2.72	0.525
2.92	0.550
3.10	0.575
3.30	0.600
3.50	0.624
3.70	0.675
3.87	0.723
3.96	0.759
4.06	0.803

CURVE 16

T	k
298	0.094

CURVE 17

T	k
426.4	0.1014
489.4	0.1090
507.9	0.1110
507.9	0.1111*
532.9	0.1139
540.9	0.1144
600.3	0.1209
652.1	0.1250
679.0	0.1262
670.0	0.1256*
715.0	0.1293
809.5	0.1358

CURVE 18

T	k
302.59	0.08468
302.57	0.08828
302.61	0.07820
302.71	0.08092
302.72	0.08117
302.75	0.08586
302.76	0.08339
302.78	0.08021
302.82	0.08389*
303.12	0.08389*
303.24	0.07971
307.50	0.08146

CURVE 18 (cont.)

T	k
307.54	0.08318
307.62	0.08494
307.65	0.08017
307.82	0.08391
307.97	0.08025*

CURVE 19

T	k
1.38	5.68
1.55	5.96
1.64	5.99
1.72	6.01
1.81	5.99
1.96	5.86
2.06	5.59
2.12	5.47
2.20	5.27
2.48	4.22
3.49	2.00*
4.23	1.35*

CURVE 20
(T 3.1K)

B (gauss)	k
8.4	0.938
74.4	0.943
87.4	0.948*
92.0	0.952
93.3	0.956*
100.0	0.962
106	0.990
114	1.04
125	1.12
136	1.24
148	1.35
160	1.53
171	1.72
176	1.96
179	2.08
181	2.18
183	2.27
186	2.40

*Not shown on plot

DATA TABLE NO. 31 (continued)

H (gauss)	k	H (gauss)	k	T	k	T	k
CURVE 20 (cont.)		CURVE 25 (T = 1.80K)		CURVE 28		CURVE 40*	
188	2.54	460	8.20	196.2	0.330	85.55	0.373
190	2.63	485	7.94	CURVE 29		CURVE 41	
CURVE 21* (T = 3.1K)		545	7.35	196.4	0.259	86.6	0.345
247	2.61	610	6.85	CURVE 30		CURVE 42	
483	2.54	655	6.49	196.8	0.341	90.6	0.334
730	2.50	730	5.95	CURVE 31		CURVE 43*	
852	2.48	790	5.52	197.5	0.324	86.2	0.359
974	2.42	825	5.35	CURVE 32		CURVE 44	
CURVE 22* (T = 3.1K)		890	5.03	197.6	0.303	290.5	0.0843
139	0.935	943	4.74	CURVE 33		CURVE 45*	
167	0.943	1000	4.48	197.1	0.312	288.2	0.0832*
177	0.990	CURVE 26 (T = 1.67K)		CURVE 34		CURVE 46*	
181	1.23	455	10.6	198.4	0.345	289.0	0.0846*
186	1.55	500	10.4	CURVE 35*		CURVE 47	
189	2.02	610	9.62	197.3	0.340	290.7	0.0842*
191	2.38	745	8.77	CURVE 36		CURVE 48	
193	2.63	825	8.77*	85.2	0.372	288.2	0.0847*
198	2.60	890	8.06	CURVE 37		CURVE 49	
CURVE 23* (T = 3.1K)		943	7.94	85.4	0.290	288.2	0.0841*
284	2.63	965	7.94*	CURVE 38		CURVE 50	
361	2.63	CURVE 27 (T = 1.98K)		80.2	0.407	287.2	0.0838*
500	2.62	440	8.55	CURVE 39		CURVE 51	
727	2.59	500	8.33	85.5	0.395	288.7	0.0832*
CURVE 24 (T = 1.40K)		625	7.75				
455	8.85	720	7.30				
500	8.06	790	6.99				
610	6.33	852	6.71				
720	5.08	910	6.71*				
825	4.20	943	6.62				
852	4.07						
890	3.76						
965	3.44						

T	k	T	k	T	k
CURVE 52		CURVE 59*		CURVE 61 (cont.)	
288.7	0.0842*	323	0.0843	580.2	0.117
CURVE 53		CURVE 60		590.2	0.118
288.7	0.0845	323.2	0.0740	606.2	0.121*
CURVE 54		CURVE 61		608.2	0.121*
277.7	0.0634	328.2	0.085	613.2	0.122*
290.2	0.0678	336.2	0.086	633.2	0.123
CURVE 55*		343.2	0.089	643.2	0.127
567.2	0.0000905	348.2	0.089	660.2	0.123
608.7	0.0000986	360.2	0.086	676.2	0.131
646.9	0.000107	368.2	0.089	700.2	0.130
685.3	0.000110	378.2	0.093	CURVE 62	
690.8	0.000114	383.2	0.094	353.2	0.084
717.3	0.000116	386.2	0.0897	368.2	0.087
CURVE 56		390.2	0.090	393.2	0.092*
303.7	0.088*	391.2	0.096	396.2	0.096*
305.2	0.0865*	400.2	0.098	398.2	0.092
309.2	0.086*	408.2	0.094	413.2	0.101
315.2	0.088	418.2	0.095	413.2	0.093
319.7	0.088	420.2	0.098	416.2	0.099*
319.7	0.0885*	430.2	0.094	418.2	0.0999*
323.7	0.089	433.2	0.099	423.2	0.093*
326.2	0.092	448.2	0.101	426.2	0.098*
329.2	0.0935*	450.2	0.099	433.2	0.096*
331.2	0.0895	453.2	0.101	443.2	0.098*
334.7	0.0905	473.2	0.104	443.2	0.103*
336.7	0.091	476.2	0.106	446.2	0.104*
341.2	0.094	488.2	0.102	450.2	0.103*
342.7	0.094	493.2	0.107	456.2	0.103*
CURVE 57*		498.2	0.108	460.2	0.100*
476.2	0.0000772	500.2	0.110*	466.2	0.106*
CURVE 58*		510.2	0.109	468.2	0.102*
313	0.082	513.2	0.108	473.2	0.101*
		518.2	0.106	478.2	0.106*
		520.2	0.113	480.2	0.103*
		536.2	0.114*	483.2	0.103*
		538.2	0.110	488.2	0.107*
		540.2	0.113*	496.2	0.105*
		543.2	0.115*	500.2	0.108*
		548.2	0.113*	506.2	0.112*
		566.2	0.116	513.2	0.106*
		575.2	0.117	516.2	0.112
				556.2	0.112

*Not shown on plot

DATA TABLE NO. 31 (continued)

T	k
CURVE 63	
333.2	0.083
346.2	0.085
356.2	0.088
366.2	0.091
373.2	0.089*
383.2	0.091*
393.2	0.094*
403.2	0.093*
403.2	0.096*
406.2	0.098*
410.2	0.094*
458.2	0.098
466.2	0.098
466.2	0.101*
473.2	0.107*
490.2	0.105*
508.2	0.108*
518.2	0.109*
558.2	0.114*
560.2	0.119
CURVE 64*	
307.2	0.0865
312.2	0.086
317.7	0.092
320.2	0.090
325.2	0.0905
325.2	0.0935
325.7	0.0955
330.2	0.096
338.2	0.0925
341.2	0.0965
343.2	0.097
351.2	0.096
CURVE 65*	
334.7	0.093
CURVE 66*	
318.7	0.090
322.2	0.090
333.2	0.0975
350.2	0.098
383.2	0.1005

T	k
CURVE 67*	
317.7	0.0880
319.2	0.0860
320.7	0.0880
323.2	0.0920
329.7	0.0945
332.2	0.0905
335.2	0.0925
342.2	0.0955
344.2	0.0955
346.7	0.0950
357.2	0.0965
362.2	0.0980
368.2	0.100
375.2	0.096
397.7	0.101
403.7	0.100
458.2	0.103
479.7	0.107
480.2	0.109
516.7	0.125
CURVE 68*	
332.2	0.098
339.7	0.0975
363.7	0.101
416.2	0.1025
CURVE 69*	
307.2	0.088
315.2	0.091
323.7	0.094
334.2	0.098
346.2	0.097
347.2	0.0975
366.2	0.0975
367.7	0.1015
CURVE 70*	
326.2	0.090
352.2	0.097
389.7	0.1015
428.2	0.106
513.7	0.1175

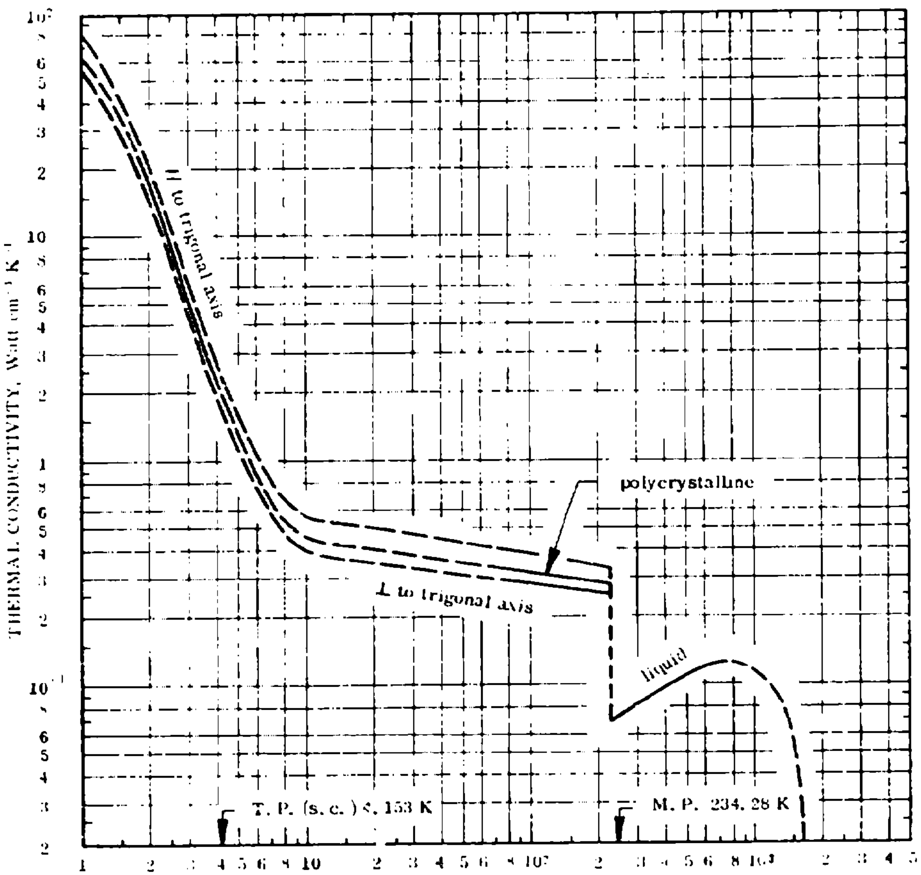
T	k
CURVE 71	
304.2	0.085
332.7	0.093
CURVE 72	
3.7879	1.631*
3.8005	1.631
3.8205	1.643
3.850	1.659
3.8660	1.684
3.8890	1.705
3.9050	1.714
3.9050	1.732
3.9230	1.732
3.940	1.743
3.9575	1.752
3.9615	1.787
3.970	1.773
3.970	1.796
3.9810	1.800
4.0095	1.842
4.0161	1.827
4.0305	1.856
4.0370	1.886
4.0410	1.855
4.046	1.917
4.062	1.906
4.066	1.889
4.073	1.905
4.088	1.924
4.016	1.904
4.0125	1.926
4.016	1.959
4.1235	1.955
4.1225	1.979
4.172	2.013
4.126	2.035
4.1325	2.055
4.1385	2.089
4.1425	2.131
4.146	2.083
4.146	2.125
4.152	2.119
4.154	2.078
4.154	2.072
4.154	2.052
4.155	2.047

T	k
CURVE 72 (cont.)	
4.160	2.041
4.1625	2.055
4.164	2.069
4.164	2.086
4.167	2.125
4.171	2.125
4.1723	2.115
4.174	2.102
4.1755	2.080
4.1805	2.071
4.1825	2.100
4.1845	2.075
4.185	2.096
4.185	2.103
4.1961	2.086
4.2032	2.089
4.2075	2.066
4.2095	2.059
CURVE 73	
3.776	2.612
3.8635	2.480
3.8810	2.437
3.8920	2.448
3.8975	2.431
3.921	2.393
3.931	2.388
3.9395	2.373
3.9625	2.342
4.0065	2.290
4.02	2.269
4.021	2.255
4.0235	2.235
4.1365	2.239
4.058	2.212
4.064	2.222
4.066	2.203
4.0815	2.204
4.083	2.195
4.0895	2.175
4.1195	2.165
4.1245	2.160
4.1315	2.128
4.1464	2.136
4.1470	2.131
4.154	2.129

T	k
CURVE 73 (cont.)	
4.1545	2.123
4.1570	2.100
CURVE 74	
3.8025	2.541
3.818	2.547
3.828	2.524
3.8495	2.519
3.8535	2.470
3.8710	2.469
3.901	2.400
3.932	2.392
3.946	2.350
3.9775	2.330
3.9805	2.309
3.9825	2.289
4.0435	2.229
4.105	2.146
4.1225	2.164
4.138	2.146
4.202	2.070
4.21	2.055
4.21	2.095
CURVE 75	
372.7	0.1050
387.6	0.1090
397.6	0.1109
401.4	0.1105
412.3	0.1146

* Not shown on plot

FIGURE AND TABLE NO. 31R RECOMMENDED THERMAL CONDUCTIVITY OF MERCURY



REMARKS

The recommended values are for 99.999+% pure mercury with residual electrical resistivity ρ_0 = 0.000296, 0.000427, and 0.000372 μΩ cm, respectively, for single crystal along directions parallel and perpendicular to trigonal axis and for polycrystalline mercury (characteriztion by ρ_0 becomes important at temperatures below about 40 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature, and 5 to 10% at other temperatures.

RECOMMENDED VALUES*

	Single Crystal (// to trig. axis)		Single Crystal (⊥ to trig. axis)		Polycrystalline		
T_1	k_1	k_2	k_1	k_2	k_1	k_2	T_2
0	0	0	0	0	0	0	-459.7
1	(82.4)‡	(4760)	(57.2)	(3310)	(65.6)	(3790)	-457.9
2	(21.5)	(1240)	(14.9)	(861)	17.1	988	-456.1
3	(6.34)	(366)	(4.40)	(254)	5.05	292	-454.3
4	(2.84)	(164)	(1.97)	(114)	2.26	131	-452.5
5	(1.66)	(95.9)	(1.15)	(66.4)	(1.32)	(76.3)	-450.7
6	(1.11)	(64.1)	(0.770)	(44.5)	(0.882)	(51.0)	-448.9
7	(0.834)	(48.2)	(0.581)	(33.6)	(0.665)	(38.4)	-447.1
8	(0.691)	(39.9)	(0.481)	(27.8)	(0.551)	(31.8)	-445.3
9	(0.615)	(35.5)	(0.429)	(24.8)	(0.491)	(28.4)	-443.5
10	(0.576)	(33.3)	(0.400)	(23.1)	(0.460)	(26.6)	-441.7
11	(0.559)	(32.3)	(0.387)	(22.4)	(0.445)	(25.7)	-439.9
12	(0.547)	(31.6)	(0.382)	(22.1)	(0.437)	(25.2)	-438.1
13	(0.538)	(31.1)	(0.377)	(21.8)	(0.432)	(25.0)	-436.3
14	(0.532)	(30.7)	(0.373)	(21.6)	(0.427)	(24.7)	-434.5
15	(0.527)	(30.5)	(0.369)	(21.3)	(0.422)	(24.4)	-432.7
16	(0.522)	(30.2)	(0.366)	(21.1)	(0.418)	(24.2)	-430.9
18	(0.512)	(29.6)	(0.360)	(20.8)	(0.410)	(23.7)	-427.3
20	(0.504)	(29.1)	(0.354)	(20.5)	(0.404)	(23.3)	-423.7
25	(0.488)	(28.2)	(0.343)	(19.8)	(0.392)	(22.6)	-414.7
30	(0.474)	(27.4)	(0.334)	(19.3)	(0.382)	(22.1)	-405.7
35	(0.462)	(26.7)	(0.327)	(18.9)	(0.373)	(21.6)	-396.7
40	(0.452)	(26.1)	(0.320)	(18.5)	(0.365)	(21.1)	-387.7
45	(0.444)	(25.7)	(0.315)	(18.2)	(0.359)	(20.7)	-378.7
50	(0.437)	(25.2)	(0.311)	(18.0)	(0.354)	(20.5)	-369.7
60	(0.424)	(24.5)	(0.304)	(17.6)	(0.345)	(19.9)	-351.7
70	(0.413)	(23.9)	(0.297)	(17.2)	(0.337)	(19.5)	-333.7
80	0.404	23.3	0.293	16.9	0.330	19.1	-315.7
90	0.396	22.9	0.288	16.6	0.324	18.7	-297.7
100	0.390	22.5	0.285	16.5	0.320	18.5	-279.7
150	0.360	20.8	0.271	15.7	0.301	17.4	-189.7
200	0.340	19.6	0.264	15.3	0.289	16.7	- 99.7
234.28	0.329	19.0	0.260	15.0	0.283	16.4	- 37.97

*T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}.

‡Values in parentheses are extrapolated or estimated.

TABLE NO. 31R (continued)

In Liquid State

T_1	k_1	k_2	T_2
234.28	0.0697	4.03	-37.97
250	0.0732	4.23	- 9.7
273.2	0.0782	4.52	32.0
300	0.0834	4.82	80.3
350	0.0915	5.29	170.3
400	0.0984	5.69	250.3
500	0.110	6.36	440.3
600	0.120	6.93	620.3
700	0.127	7.34	800.3
800	0.128	7.40	980.3
900	(0.124)[‡]	(7.16)	1160
1000	(0.117)	(6.76)	1340
1100	(0.108)	(6.24)	1520
1200	(0.0984)	(5.69)	1700
1300	(0.0872)	(5.04)	1880
1400	(0.0732)	(4.23)	2060
1500	(0.0559)	(3.23)	2240
1600	(0.0345)	(1.99)	2420
1700	(0.0094)	(0.543)	2600
1733	(0.00045)	(0.026)	2660

[‡] Values in parentheses are extrapolated or estimated.

FIGURE SHOWS ONLY 31 OF THE CURVES REPORTED IN TABLE

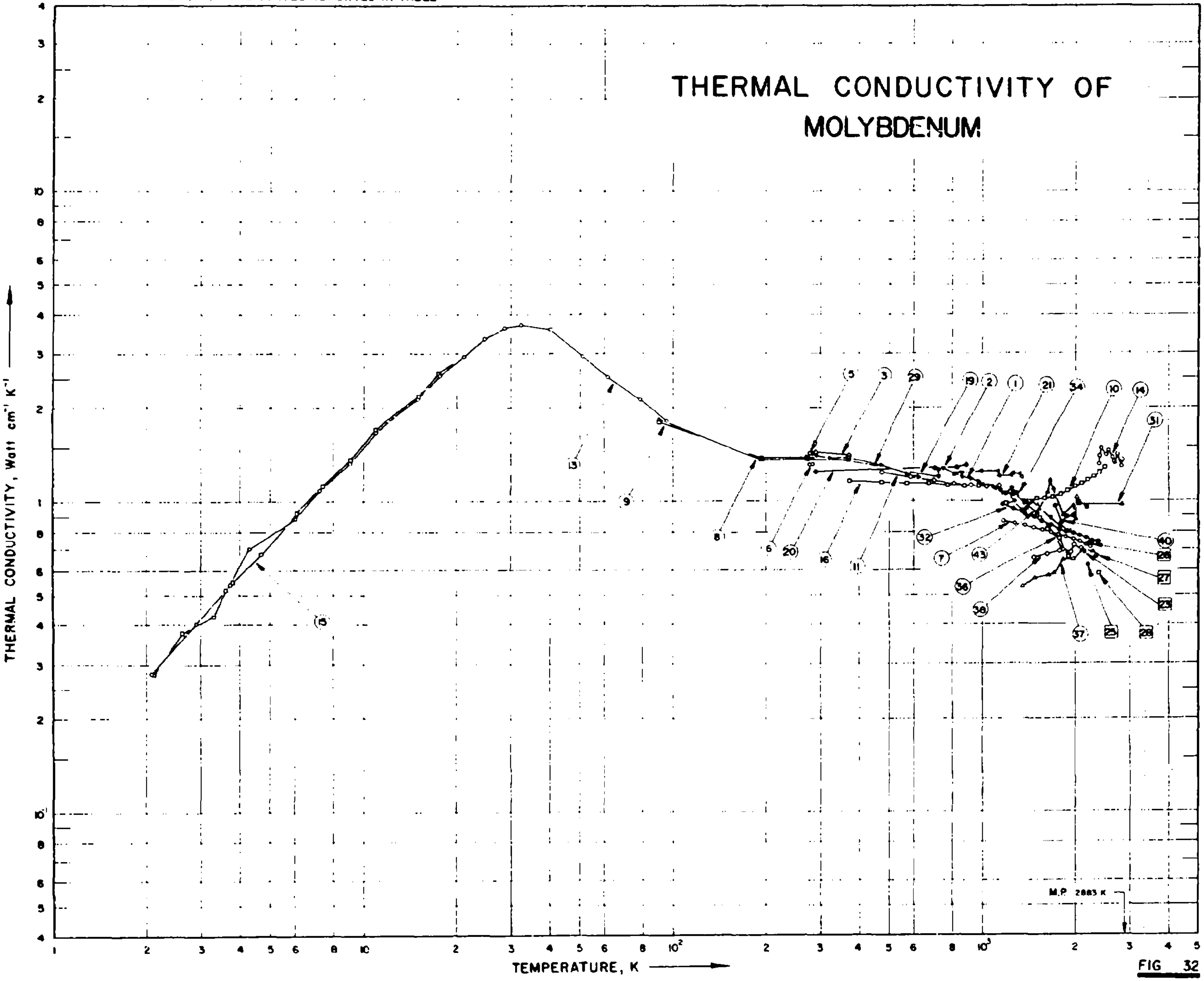


FIG 32

SPECIFICATION TABLE NO. 32 THERMAL CONDUCTIVITY OF MOLYBDENUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 32]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	100	R	1952	811-1422	5		99.9 Mo, < 0.005 Fe, and < 0.003 C; test specimen consisted of 5 stacked disks each of ~5 in. O.D., 0.75 in. I.D., and 0.50 in. thick; obtained from Fansteel Metallurgical Corp.; prepared by powder-metallurgy techniques; pressed, sintered, then rolled to finished size at just below the recrystallization temperature.
2	40	L	1956	749-1915	5		Pure; 7 in. dia x 1.5 in. thick; arc-melted.
3	8	F	1914	290, 373			Pure; 0.0520 cm dia x 45.0 cm long; density 9.933 g cm^{-3}; electrical resistivity reported as 5.806 and 8.516 μohm cm at 0 and 100 C, respectively.
4	78	E	1931	277, 283	2	Mo I	Pure; 0.09983 cm dia x 9.915 cm long; annealed at 220 C; electrical resistivity reported as 5.10 and 5.51 μohm cm at 0 and 18 C, respectively.
5	78	E	1931	278, 283	2	Mo I	The above specimen annealed at 900 C; electrical resistivity 5.07 μohm cm at 0 C.
6	78	E	1931	277, , 282	2	Mo II	Less pure than the above sample; 0.1069 cm dia x 10.14 cm long; annealed at 220 C; electrical resistivity reported as 5.81 and 6.22 μohm cm at 0 and 18 C, respectively.
7	723	R	1965	1173-2248			0.0269 C, < 0.01 Ca, < 0.01 Cu, < 0.01 Fe, < 0.01 Mg, < 0.01 Si, 0.0006 H, 0.0006 O, and 0.00019 N; as received; specimen 1.985 ± 0.015 in. in dia; arc-cast; electrical resistivity reported as 5.6, 17.8, 32.2, 48.0, 63.2, and 73.3 μohm cm at 0, 500, 1000, 1500, 2000, and 2300 C, respectively; density 99% of theoretical value; measurements made on 7 heating and cooling cycles, mean values taken from data of 4th to 7th cycles reported.
8	79	E	1933	90-373		Mo I	99.836* Mo, 0.05 Bi, 0.05 Cd, 0.01 Al, 0.01 Ge, 0.01 Sn, 0.01 Ti, 0.01 V, 0.01 W, 0.001 Co, 0.001 Cu, 0.001 Pt, 0.001 Rh, and trace of C; 0.09979 cm dia x 12.627 cm long; electrical resistivity reported as 0.952, 3.39, 5.25, and 7.67 μohm cm at -183.00, -78.50, 0, and 100 C, respectively.
9	79	E	1933	90-373		Mo 2	Cut from the same wire as the above specimen; 0.09980 cm dia x 9.859 cm long; electrical resistivity reported as 0.882, 3.33, 5.17, 7.56, and 10.05 μohm cm at -183.00, -78.50, 0, 100, and 217.96 C, respectively.
10	156	E	1927	1200-2500			Pure; electrical resistivity reported as 29.2, 32.2, 35.2, 38.2, 41.2, 44.3, 47.3, 50.4, 53.5, 56.6, 59.7, 62.8, 66.0, and 69.2 μohm cm at 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, and 2500 K, respectively.
11	89	C	1956	478-1144			Pure; supplied by Climax Molybdenum Co.; 2 cm dia x 15 cm long; arc melted; density 10.24 g cm^{-3}; Armco iron used as comparative material.
12	996	L	1967	86-377			Spectroscopically standardized molybdenum; 5 mm dia x 10 cm long; supplied by Johnson, Matthey & Co.; electrical resistivity reported as 0.18, 0.57, 0.80, 3.20, 5.55, and 7.31 μohm cm at 4, 76, 91, 194, 297, and 374 K, respectively.

SPECIFICATION TABLE NO. 32 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
13	122	L	1955	2.1-95	± 3	JM 2331; Mo 1	99.95 pure; polycrystalline; 0.52 cm dia x 2.85 cm long; obtained from Johnson, Matthey; electrical resistivity reported as 1.44, 1.44, 1.45, 1.49, 1.51, 1.80, 2.26, and 2.84 μ ohm cm at 20.4, 25.2, 29.3, 37.2, 48.6, 58.8, 75.3, and 90.1 K, respectively.
14	255	E	1960	2384-2849			0.18 Fe, 0.073 Si, 0.04 C, 0.036 Mn, 0.005 O, and 0.01 others; arc-melted and cast under inert gas, hot-worked, and hot-rolled, polished; 0.125 in. dia x 10 in. long; obtained from Fansteel Corp.
15	97	L	1952	2.1-21	2-3	JM 2331; Mo I	99.95 pure; 1-2 mm dia x 5 cm long; supplied by Johnson-Matthey.
16	414	L	1954	373-973	± 2		Coarse grain structure on the outside and fine grain structure in the interior; with a large number of inclusions; 1 in. bar, forged and machined.
17	503	E	1961	1068-1183			99.98 pure; 1 mm wire; obtained from Radium-Elektrizitatsqesellsch, Wipperfurth; polished; annealed in vacuo for 12 hrs at about 1000 C; electrical resistivity reported as 24.4, 25.5, 26.9, 28.3, and 29.7 μ ohm cm at 761, 800, 850, 900, and 950 C, respectively.
18	543	C	1955	473-1173	± 5	Heat No. 990	Recrystallized at 1505 C; measured in a vacuum of 2 x 10^{-5} mm Hg; Armco iron used as comparative material; data taken from smoothed curve.
19	599	E	1961	290-871			99.9 pure; received from Fansteel Metallurgical Corp; electrical resistivity 5.98 μ ohm cm at 23 C.
20	599	E	1961	290-890			2nd run of the above specimen.
21	599	E	1961	290-1325			3rd run of the above specimen.
22	1011	E	1961	1122.1727			Tubular specimen 8 mm O.D., 5 mm I.D., and 100 mm long.
23	601		1962	2129			Heated in high vacuum (10^{-5} mm Hg) by high frequency induction to 1000 to 3000 C; localized heating within 0.003 in. of the surface at current frequencies of 500000 cps; specimen 0.4923 in. in dia and 0.863 in. in length; measured with the cylindrical axis parallel to the magnetic field; run G-2.
24	601		1962	2161			The above specimen; run G-3.
25	601		1962	2200			The above specimen; run G-5.
26	601		1962	2216.5			The above specimen; run G-4.
27	601		1962	2351.5			The above specimen; run M-1.
28	601		1962	2382			The above specimen; run M-3.
29	652	L, C	1961	323-623		JM 720	Spectrographically standardized molybdenum; obtained from Johnson, Matthey and Co.; rod of about 5 mm in dia and 15 cm in length; electrical resistivity reported as 5.65, 6.25, 7.45, 9.9, 12.45, 13.75, 15.1, 17.85, 20.6, 23.3, 26, 28.7, 31.5, 34.4, 37.2, 40.1, 43, and 44.7 μ ohm cm at 20, 50, 100, 200, 300, 350, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, and 1450 C, respectively; Armco iron used as comparative material.

SPECIFICATION TABLE NO. 42 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
30	653	E	1963	1075-1640			Single crystal; ~~Lorentz~~ Lorenz function reported as 2.87, 2.76, 2.72, 2.71, 2.66, 2.57, and 2.33 x $10^{-8} V^2 K^{-2}$ at 1080, 1200, 1310, 1320, 1420, 1540, and 1650 K, respectively.
31	667	E	1962	1520-2085	± 10		Spectrographically pure; wire specimen 0.010 in. in dia; electrical resistivity reported as 41.3, 50.6, 58.1, and 59.1 μ ohm cm at 1550, 1830, 2040, and 2110 K, respectively; measured in a vacuum of < 10^{-5} mm Hg.
32	600, 709	E	1960	1173-2473			Wire; 1 mm in dia, 30 mm long; electrical resistivity reported as 27.8, 35.6, 45.2, 56.4, and 74.8 μohm cm at 1173, 1473, 1773, 2073, and 2473 K, respectively; data taken from smoothed curve.
33	654	P	1965	1340-2510	± 5		99.99 Mo (by difference), < 0.01 Fe, and traces of other elements; 0.04 in. thick sheet; obtained from Murex Co.; sintered and hot rolled; average grain size (after test) 110 μ; density 10.3 g cm^{-3}; thermal conductivity values calculated from measured thermal diffusivity data using the specific heat data compiled by Kubaschewski, O., and Evans, L. Ll. (Metallurgical Thermochemistry, Pergamon, London, 1956).
34	710	E	1938	1207-1400			Very pure; 20-mil wire; polished; aged at about 2200 K for 15 min; electrical resistivity reported as 26.4, 32.3, 37.8, 42.8, and 47.4 μohm cm at 1110, 1325, 1515, 1685, and 1840 K, respectively.
35	710	E	1938	1315-1647			Same as the above specimen.
36	710	E	1938	1545-1905			Same as the above specimen.
37	711	R	1965	1362-2282	6	Sample 1	99.98+ Mo, 0.005 Fe, 0.004 Si, 0.003 Ni, 0.0023 O, 0.0021 C, 0.001 V, < 0.0005 N, and 0.00023 H; specimen 2.118 cm in dia and 0.225 cm thick; prepared by powder metallurgy techniques; polished with No. 4/0 emery paper; average grain dia 34 μ; density 9.104 g cm^{-3}; experiment performed in high vacuum (10^{-5} mm Hg); specimen heated by high frequency induction current; specimen axis parallel to the axis of magnetic field; data calculated from total emittance measurements using specific heat data from an empirical formula whose agreement with those of Kirilin, V.A. et al was within 2%; run No. 1.
38	711	R	1965	1476-2100	6	Sample 1	99.964+ Mo, 0.028 C, 0.0021 O, 0.002 Si, 0.001 Cu, 0.001 Fe, 0.001 V, < 0.0005 N, and 0.00015 H; specimen 1.905 cm in dia, 0.206 cm thick; prepared by arc-melting technique; average grain dia 706 μ; density 10.119 g cm^{-3}; same measuring conditions and method as above; run No. 1.
39	711	R	1965	1687-2272	6	Sample 2	The above specimen; run No. 2.
40	711	R	1965	1740-2194	6	Sample 3	99.948+ Mo, 0.011 C, < 0.01 Fe, < 0.01 Si, < 0.01 Ti, < 0.01 Zr, 0.003 O, 0.0006 N, and 0.0002 H; specimen 1.910 cm in dia, 0.195 cm thick; prepared by arc-melting and heated to 2500 K for very long times in hydrogen such that it underwent grain growth; average grain dia 4850 μ; density 10.163 g cm^{-3}; same measuring condition and method as above; run No. 1.
41	711	R	1965	1592-1974	6	Sample 3	The above specimen; run No. 2.

SPECIFICATION TABLE NO. 32 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
42	744	E	1966	1609-2355	7		No details reported.
43	845, 844	P	1966	1140-1816		Specimen 1	99.9 Mo, 0.01 Mo_2O_3, 0.001 Ni, 0.001 SiO, traces ~~Mg~~ MgO and CaO; cylindrical specimen 10 mm in dia and 70 mm long; density 10.2 g cm^{-3} at room temp; electrical resistivity reported as 5.78 μohm cm at 23 C; thermal conductivity values calculated from measured data of thermal diffusivity, specific heat, and density; reported values taken from smoothed curve.

DATA TABLE NO. 32 THERMAL CONDUCTIVITY OF MOLYBDENUM

[Temperature, T, K; Thermal Conductivity, k, Watt cm⁻¹K⁻¹]

T	k
CURVE 1	
810.3	1.217
866.5	1.196
922.1	1.175
977.6	1.154
1033.2	1.132*
1088.7	1.111
1144.3	1.089
1199.8	1.066*
1255.4	1.045
1310.9	1.021*
1366.5	0.999
1422.1	0.978
CURVE 2	
748.7	1.269
819.3	1.218
999.3	1.130
1170.9	1.042
1172.0	1.076
1279.8	0.999
1455.3	0.997
1662.1	0.884
1785.9	0.834
1915.3	0.805
CURVE 3	
290.2	1.448
373.2	1.393
CURVE 4*	
276.7	1.390
282.5	1.396
CURVE 5	
277.8	1.436
283.4	1.432
CURVE 6	
277.1	1.319
282.2	1.323
CURVE 7	
1173.2	0.866
1273.2	0.852
1373.2	0.839
1473.2	0.825
1573.2	0.811
1673.2	0.797
1773.2	0.784
1873.2	0.770
1973.2	0.756
2073.2	0.742
2173.2	0.729
2248.2	0.718
CURVE 8	
90.2	1.853
194.7	1.364
273.2	1.368
373.2	0.372
CURVE 9	
90.2	1.799
194.2	1.377
273.2	1.377
373.2	1.377
CURVE 10	
1200	0.980
1300	0.990*
1400	1.000*
1500	1.010
1690	1.020
1700	1.030
1800	1.050
1900	1.080
2000	1.110
2100	1.140
2200	1.170
2300	1.200
2400	1.240
2500	1.280
CURVE 11	
477.6	1.246
588.7	1.194
699.8	1.160
810.9	1.139
922.1	1.125
1033.2	1.116
1144.3	1.108
CURVE 12	
85.6	1.895
86.9	1.879
96.3	1.737
98.4	1.713
198.7	1.420
201.7	1.422
277.4	1.388
280.7	1.386
333.4	1.349
336.5	1.352
369.8	1.322
372.3	1.323
376.6	1.323
CURVE 13	
2.08	0.280
2.90	0.402
3.73	0.541
4.30	0.704
6.02	0.882
7.25	1.095
9.02	1.330
11.00	1.664
14.95	2.145
17.61	2.550
21.15	2.925
24.70	3.336
28.50	3.614
32.35	3.680
40.00	3.565
51.20	2.940
61.80	2.525
78.35	2.135
95.35	1.810
CURVE 14	
2384	1.314
2400	1.402
2442	1.481
2530	1.410
2561	1.456
2647	1.381
2670	1.339
2676	1.331
2748	1.418
2833	1.289
2849	1.356
CURVE 15	
2.1	0.28
2.6	0.375
3.3	0.425
3.6	0.52
3.8	0.55
4.7	0.675
6.1	0.92
7.4	1.11
9.1	1.36
11.0	1.68
15.2	2.17
17.6	2.56
21.3	2.95*
CURVE 16	
373.2	1.155
473.2	1.146
573.2	1.142
673.2	1.138
773.2	1.130
873.2	1.125
973.2	1.121
CURVE 17*	
1068.2	1.15
1088.2	1.1[illegible]
1113.2	1.135
1138.2	1.105
1183.2	1.05
CURVE 18*	
473.2	1.21
573.2	1.18
673.2	1.16
773.2	1.14
873.2	1.11
973.2	1.10
1073.2	1.09
1173.2	1.08
CURVE 19	
290	1.42
725	1.20
725	1.26
861	1.22
871	1.23*
CURVE 20	
290	1.25
710	1.27
830	1.29
890	1.31
CURVE 21	
290	1.38*
720	1.22*
850	1.25*
992	1.25
995	1.21*
1132	1.25
1138	1.20
1240	1.20
1261	1.22
1322	1.22
1325	1.19
CURVE 22*	
1122	1.09
1122	1.08
1727	0.920
1727	0.870
CURVE 23	
2129	0.684
CURVE 24*	
2161	0.704
CURVE 25	
2200	0.620
CURVE 26	
2216.5	0.737
CURVE 27	
2351.5	0.663
CURVE 28	
2382	0.582
CURVE 29	
323.2	1.37
373.2	1.35*
473.2	1.31
573.2	1.23
623.2	1.19
CURVE 30*	
1075	1.12
1200	1.05
1315	1.02
1330	1.02
1435	1.00
1545	0.95
1640	0.855
CURVE 31	
1520	1.00*
1540	0.941
1635	1.07
CURVE 31 (cont.)	
1660	1.17
1700	1.09
1840	0.900
1980	0.962
2010	0.879
2030	1.03
2060	0.971
2085	0.971
CURVE 32	
1173.2	0.975
1273.2	0.943
1373.2	0.915
1473.2	0.890
1573.2	0.860
1673.2	0.840
1773.2	0.820
1873.2	0.800
1973.2	0.790
2073.2	0.775
2173.2	0.765
2273.2	0.755
2373.2	0.745
2473.2	0.740
CURVE 33*	
1340	0.841
1400	0.836
1500	0.829
1600	0.822
1700	0.814
1800	0.807
1900	0.799
2000	0.792
2100	0.784
2200	0.777
2300	0.770
2400	0.762
2510	0.754
CURVE 34	
1207	1.060
1253	1.100
1300	1.063
1400	0.945
CURVE 35*	
1315	1.011
1442	0.941
1543	0.869
1647	0.817
CURVE 36	
1545	0.883
1642	0.818
1783	0.760
1905	0.660
CURVE 37	
1361.5	0.531
1489.5	0.565
1650.0	0.577
1719.0	0.586
1841.0	0.649
1975.5	0.649
2110.0	0.695
2209.5	0.707*
2282.0	0.686
CURVE 38	
1475.5	0.657
1638.0	0.674
1778.0	0.690
1833.0	0.695
1945.0	0.682
1983.5	0.728
2100.5	0.707
CURVE 39*	
1686.5	0.665
1906.0	0.728
2101.0	0.720
2202.5	0.757
2271.5	0.799
CURVE 40	
1740.5	0.966
1810.0	0.858

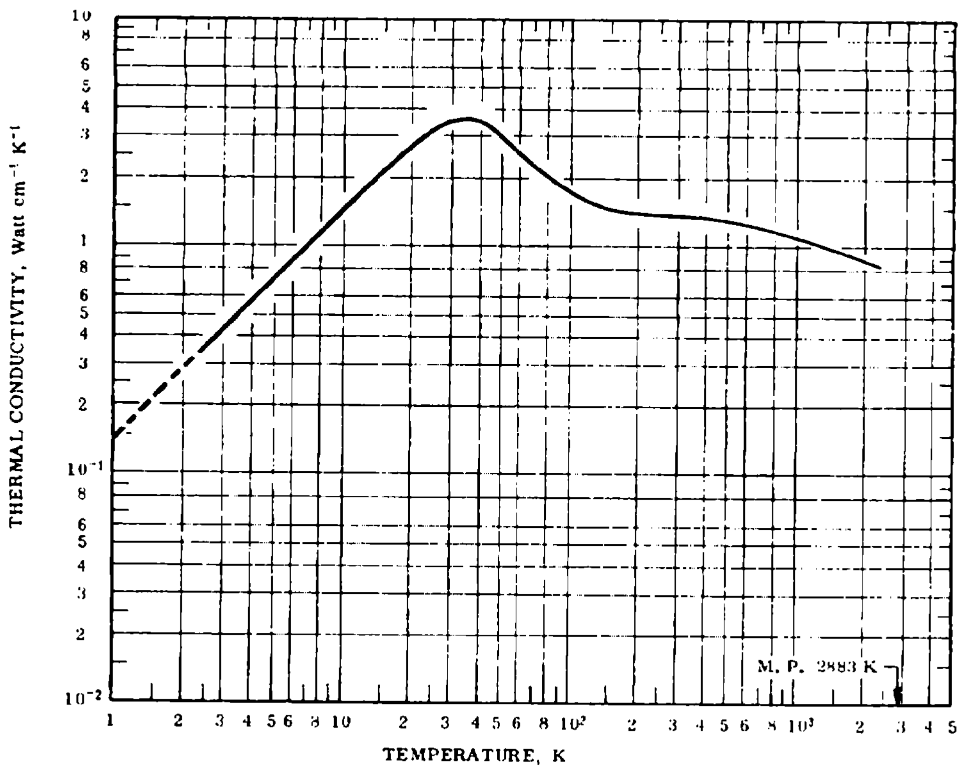
* Not shown on plot

DATA TABLE NO. 32 (continued)

T	k
CURVE 40 (cont.)	
1880.0	0.891
1970.5	0.895
2062.5	0.992
2194.5	0.950
CURVE 41*	
1592.0	0.854
1733.0	0.824
1889.5	0.828
1933.5	0.916
1974.0	0.929
CURVE 42*	
1609	0.960
1765	0.950
1875	0.920
2005	0.940
2105	0.960
2275	0.960
2355	0.880
CURVE 43	
1140	1.125
1253	1.061
1380	0.983
1500	0.913
1635	0.824
1816	0.704

* Not shown on plot

FIGURE AND TABLE NO. 32R RECOMMENDED THERMAL CONDUCTIVITY OF MOLYBDENUM



REMARKS

The recommended values are for well-annealed 99.95⁺% pure molybdenum with residual electrical resistivity ρ_0 = 0.167 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 250 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.60, α' = 7.76 x 10^{-6}, and β = 6.85. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature, and 4 to 10% at other temperatures.

RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	1.30	75.1	440.3
1	(0.146)‡	(8.44)	-457.9	600	1.26	72.8	620.3
2	(0.292)	(16.9)	-456.1	700	1.22	70.5	800.3
3	0.438	25.3	-454.3	800	1.18	68.2	980.3
4	0.584	33.7	-452.5	900	1.15	66.4	1160
5	0.730	42.2	-450.7	1000	1.12	64.7	1340
6	0.876	50.6	-448.9	1100	1.08	62.4	1520
7	1.02	58.9	-447.1	1200	1.05	60.7	1700
8	1.17	67.6	-445.3	1300	1.02	58.9	1880
9	1.31	75.7	-443.5	1400	0.996	57.5	2060
10	1.45	83.8	-441.7	1500	0.970	56.0	2240
11	1.60	92.4	-439.9	1600	0.946	54.7	2420
12	1.74	101	-438.1	1700	0.925	53.4	2600
13	1.88	109	-436.3	1800	0.907	52.4	2780
14	2.01	116	-434.5	1900	0.893	51.6	2960
15	2.15	124	-432.7	2000	0.880	50.8	3140
16	2.28	132	-430.9	2200	0.858	49.6	3500
18	2.53	146	-427.3	2400	0.840	48.5	3860
20	2.77	160	-423.7	2600	0.825	47.7	4220
25	3.25	188	-414.7	2800	0.813	47.0	4580
30	3.55	205	-405.7				
35	3.62	209	-396.7				
40	3.51	203	-387.7				
45	3.26	188	-378.7				
50	3.00	173	-369.7				
60	2.69	150	-351.7				
70	2.30	133	-333.7				
80	2.09	121	-315.7				
90	1.92	111	-297.7				
100	1.79	103	-279.7				
150	1.49	86.1	-189.7				
200	1.43	82.6	-99.7				
250	1.40	80.9	-9.7				
273.2	1.39	80.3	32.0				
300	1.38	79.7	80.3				
350	1.36	78.6	170.3				
400	1.34	77.4	260.3				

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

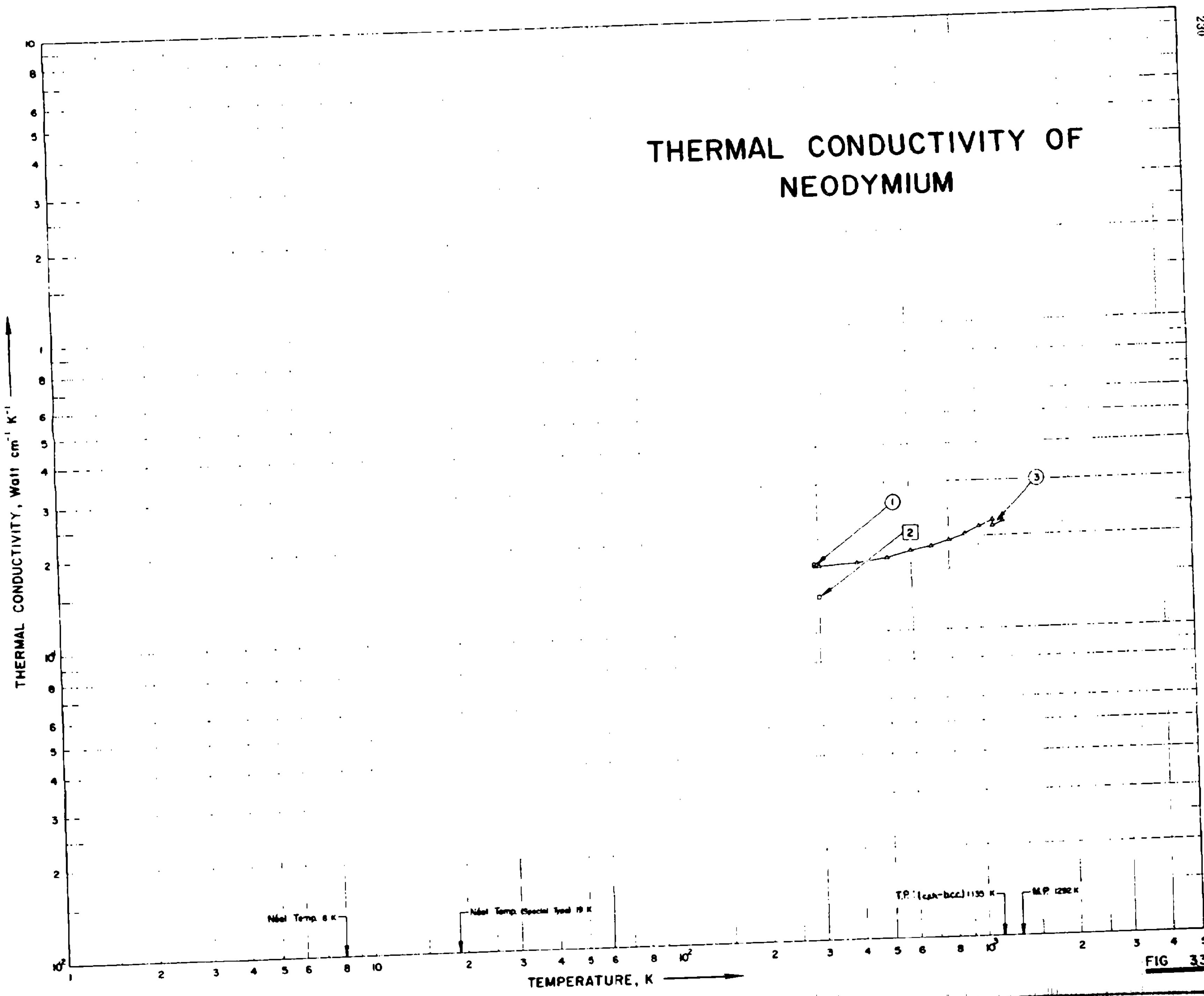

THERMAL CONDUCTIVITY OF
NEODYMIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Néel Temp. 8 K
Néel Temp. (Special Type) 19 K
T.P. (cph-bcc) 1135 K
M.P. 1292 K
1
2
3

FIG 33

SPECIFICATION TABLE NO. 33 THERMAL CONDUCTIVITY OF NEODYMIUM

(Impurity < 0.20% each, total impurities < 0.50%)

[For Data Reported in Figure and Table No. 33]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	777	C	1965	291.2	± 3.0		High purity; polycrystalline; specimen 0.25 in. in diameter and 0.25 in. long; supplied by Johnson Matthey Co.; electrical resistivity 65 μ ohm cm at 18 C. Monel metal used as comparative material; measurements made usi.. 2 different thermal comparators.
2	811		1954	301	± 10.0		No details reported.
3	999	–	1966	300-1200			Estimated values given as the sum of electronic thermal conductivity and the lattice thermal conductivity where electronic thermal conductivity values calculated from the theoretical Lorenz number $L_0 = 2.443 \times 10^{-8}\ V^2\ K^{-2}$ and the estimated electrical resistivity reported as 65, 76, 86, 95, 104, 112, 118, 123, 128, 130 (α), 136 (β), and 136 μohm cm at 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1120, 1120, and 1200 K, respectively, whereas lattice thermal conductivity values calculated from the empirical equation $k_L = 15.6\ T^{-1}$.

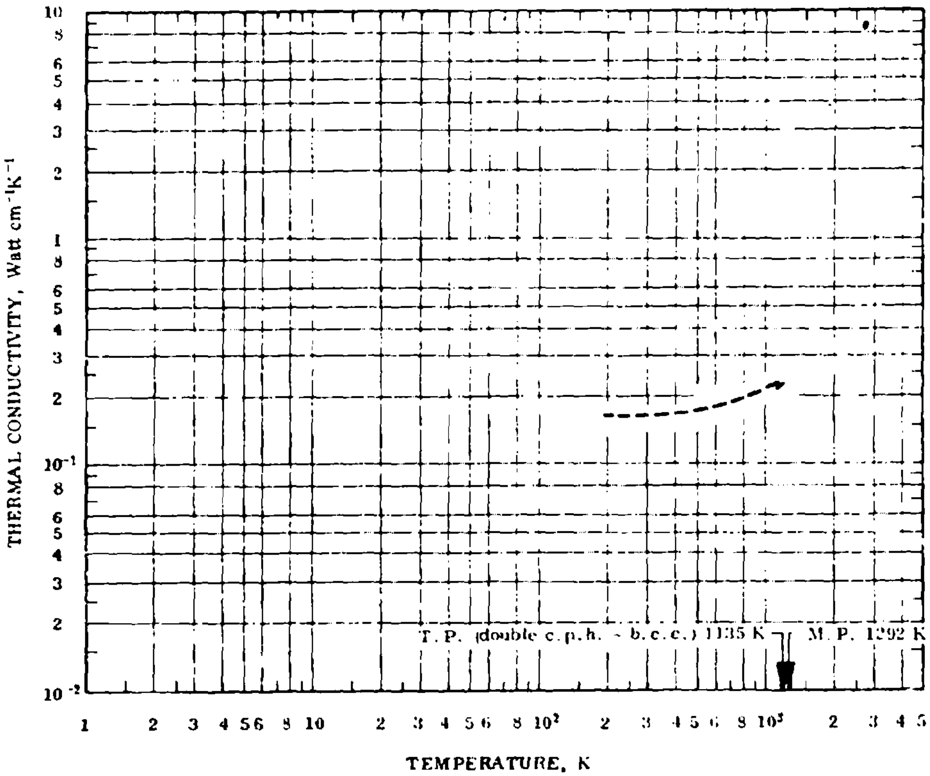
DATA TABLE NO. 33 THERMAL CONDUCTIVITY OF NEODYMIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
291.2	0.165
291.2	0.166
CURVE 2	
301	0.130
CURVE 3	
300	0.165
400	0.168
500	0.173
600	0.181
700	0.187
800	0.195
900	0.203
1000	0.215
1100	0.224
1120	0.225
1120	0.215
1200	0.224

FIGURE AND TABLE NO. 33R RECOMMENDED THERMAL CONDUCTIVITY OF NEODYMIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
200	(0.166)‡	(9.59)	- 99.7
250	(0.164)	(9.48)	- 9.7
273.2	(0.165)	(9.53)	32.0
300	0.165	9.53	80.3
350	(0.166)	(9.59)	170.3
400	(0.168)	(9.71)	260.3
500	(0.173)	(10.0)	440.3
600	(0.180)	(10.4)	620.3
700	(0.187)	(10.8)	800.3
800	(0.195)	(11.3)	980.3
900	(0.203)	(11.7)	1160
1000	(0.215)	(12.4)	1340
1100	(0.224)	(12.9)	1520
1120	(0.225)	(13.0)	1556
1140	(0.217)	(12.5)	1556
1200	(0.224)	(12.9)	1700

REMARKS

The recommended values are for high-purity neodymium. The recommended values are thought to be accurate to within 5% of the true values near room temperature.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are estimated.

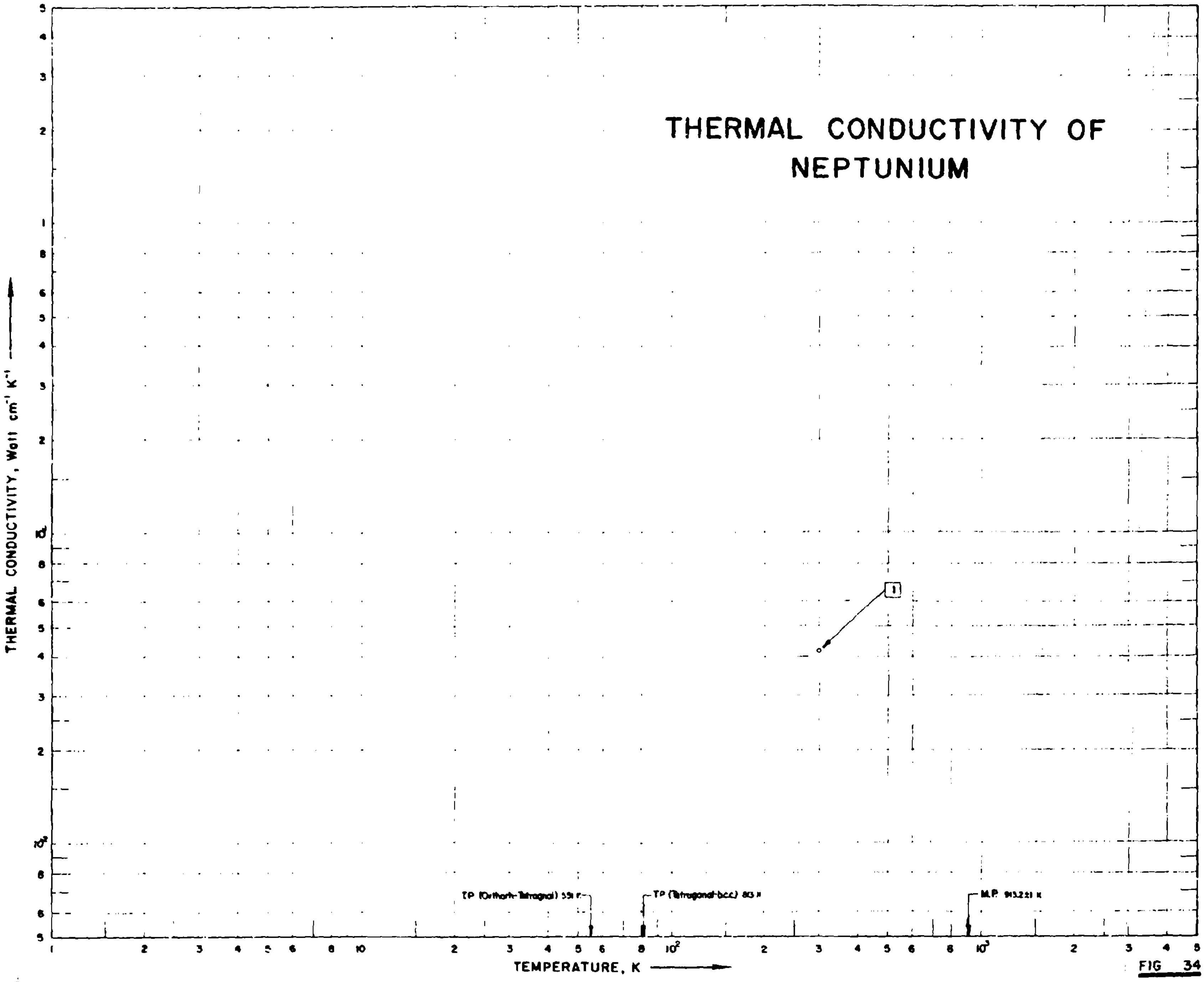

THERMAL CONDUCTIVITY OF NEPTUNIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
TP (Orthorh-Tetragonal) 551 K
TP (Tetragonal-bcc) 813 K
M.P. 913.2±1 K
1

FIG 34

SPECIFICATION TABLE NO. 34 THERMAL CONDUCTIVITY OF NEPTUNIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 34]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	819		1961	300			Neptunium in α-phase; data determined from resistivity measurements using Kannuluik method; electrical resistivity reported as 116.4, 116.1, 117.7, 117.8, 119.1, 119.3, 120.5, 120.7, 120.9, 120.8, and 121.3 μohm cm at 310, 314, 334, 347, 370, 373, 425, 433, 472, 512, and 538 C, respectively.

DATA TABLE NO. 34 THERMAL CONDUCTIVITY OF NEPTUNIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
300	0.0418

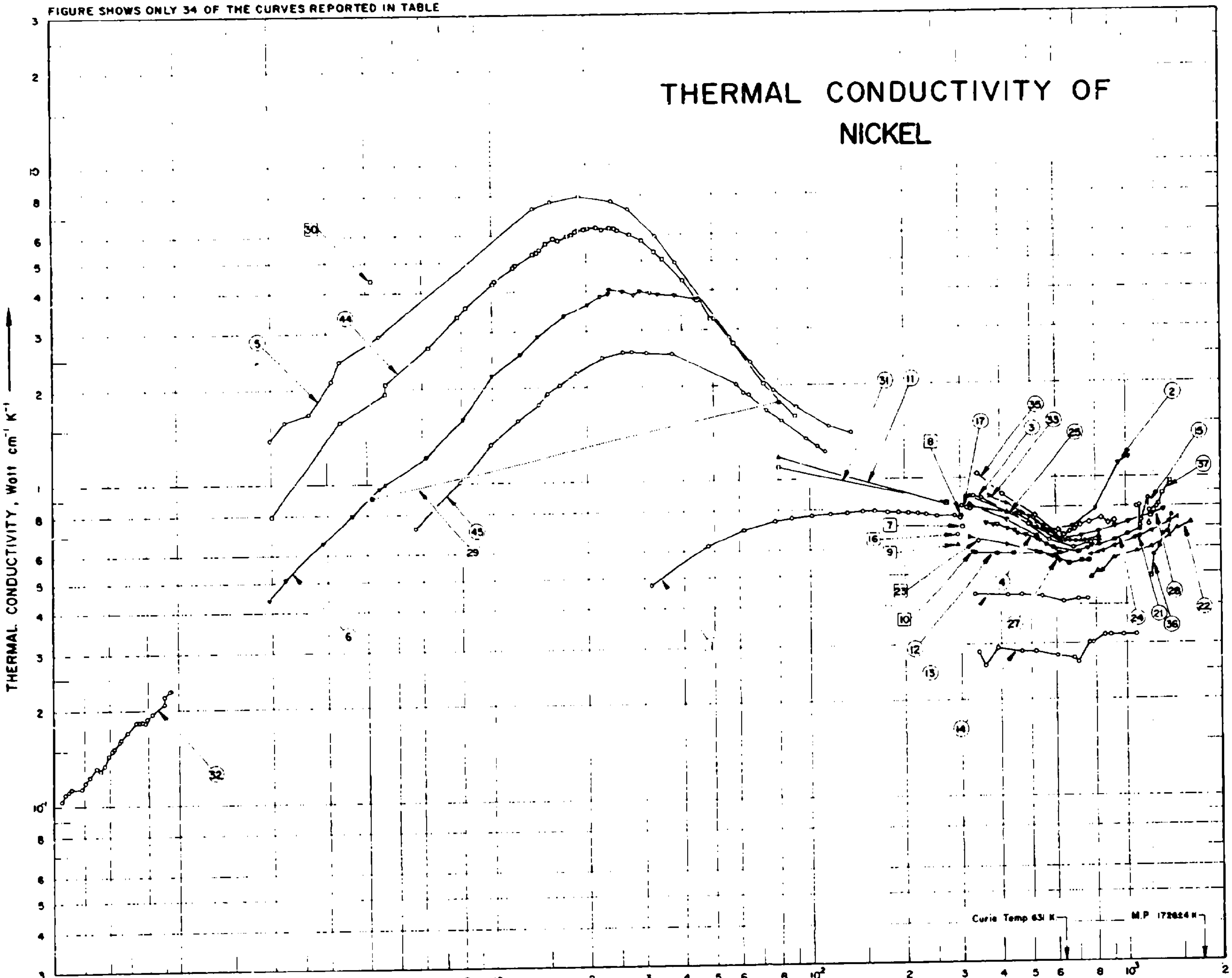


FIGURE SHOWS ONLY 34 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF NICKEL
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Curie Temp 631 K
M.P. 1728.4 K

FIG 35

SPECIFICATION TABLE NO. 35 THERMAL CONDUCTIVITY OF NICKEL

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 35]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	114	L	1950	32-300	1.2-2.0	"L" Nickel	Commercially pure; 0.5 in. dia x 20 in. long; supplied by International Nickel Co.
2	124	P	1930	327-1016			Pure nickel, electrolyzed from Mond anodes; wire, about 0.2 cm in dia; vacuum melted under a pressure of 0.3 mm Hg using an Arsen furnace and an alundum crucible; chill cast, forged, and cold drawn to the above dimensions, annealed twice at about 750 C for several hrs; electrical conductivity reported as 9.60, 5.95, 4.10, 3.03, 2.74, 2.47, and 2.32 x 10^4 ohm^{-1} cm^{-1} at 54, 179, 285, 407, 530, 676, and 743 C, respectively; density 8.74 g cm^{-3}; thermal conductivity values calculated from measured data of thermal diffusivity, specific heat, and density.
3	129	C	1933	330-775	5	N_1	99.94 Ni, 0.03 Fe, 0.016 Co, 0.006 Cu, 0.006 Si, 0.005 C, and 0.004 S; specimen 2 cm in dia and 15 cm long; melted in Arsen furnace and furnace cooled; lead used as comparative material, reference value taken from International Critical Tables ~~(Vol. II, p. 210)~~ (Vol. V, p. 221).
4	101	L	1955	363-780	3		99.65 pure (by difference), 0.094 Si, 0.082 Cu, 0.056 Fe, 0.027 C, 0.025 Co, 0.008 S, and 0.007 Al; specimen 7.938 in. long and 0.787 in. in dia; prepared in a zircon crucible from high purity electrolytic nickel shot, hot rolled at 1000 C to a bar 1 in. square, machined and ground to size; annealed for 45 min at 1000 C in hydrogen atmosphere.
5	83	L	1956	2.0-136		JM 4497	99.99+ Ni, traces of Al, Ca, Cu, Si, Ag, and very faint traces of Li, Mg, and Na; material obtained from Johnson Matthey Co.; specimen 2 mm in dia; annealed for 4 hrs in vacuo at 750 C; electrical resistivity 7.22 μohm cm at 293 K; residual electrical resistivity 0.0347 μohm cm.
6	122	L	1955	2.0-44	3	JM 4884; Ni 1	99.997 pure; polycrystalline; specimen 2.92 cm long, 0.305 cm in dia; obtained from Johnson Matthey Co. (JM 4884); annealed at 1150 C for several hrs in vacuo; electrical resistivity ratio $\rho(293K)/\rho(20K)$ = 80.9.
7	186	P	1928	305.2		R-12	Wire about 35 cm long, 0.32 cm in dia; electrical conductivity 9.66 x 10^4 ohm^{-1} cm^{-1} at approx 32 C; thermal conductivity value calculated from measured data of thermal diffusivity and specific heat.
8	238	E	1927	303.2			0.10 Fe, 0.037 C, 0.019 S, 0.013 Cu, 0.006 Si, traces of Al, Co, Mn, and P; specimen 20 cm long, 5 mm in dia; obtained from Mond and Co.; cast and machined, annealed for 40 min at 800 C; electrical resistivity 8.58 μohm cm at 30 C.
9	499	P	1937	298.2	0.06		99.98+ pure; annealed in hydrogen at 870 C; density 8.79 g cm^{-3}; electrical resistivity 7.21 μohm cm at 22 C; thermal conductivity value calculated from measured data of thermal diffusivity, specific heat, and density.
10	230	L	1925	329.2		Electrolytic nickel	99.75-99.85 pure; supplied by International Nickel Co. of America; electrical conductivity 8.24 x 10^4 ohm^{-1} cm^{-1}.
11	496	C	1940	80, 273	< 1		Specimen 60 mm long, 4 mm in dia; copper used as comparative material.
12	500	C	1954	333-763		Nivac	Extremely pure; specimen 1 in. cube; supplied by the Vacuum Metal Corp; vacuum cast.
13	500	C	1954	333-753			Similar to the above specimen but with cylindrical pores of 0.[illegible]46 cm in dia; porosity 9.8%.

SPECIFICATION TABLE NO. 35 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
14	500	C	1954	343-1073			Similar to the above specimen but porosity 19.5%.
15	503	E	1961	1093-1263		Nickel O	99.95 pure; wire 1 mm in dia; vacuum melted and cast; polished; annealed for 12 hrs at ~1000 C.
16	504	P	1961	295.2	± 5		1.26 cm dia x 0.100 cm thick; thermal conductivity value calculated from measured data of thermal diffusivity and specific heat, and density value taken from Smithsonian Physical Tables (9th ed., 1954).
17	618	C	1960	305-323	± 3		Specimen 20 mm in dia and 18 mm long; steel used as comparative material.
18	618	C	1960	303-317	± 3		The above specimen using pure Ni as comparative material.
19	618	C	1960	302-320	± 3		The above specimen using yellow brass as a comparative material.
20	618	C	1960	305-321	± 3		The above specimen using Al as comparative material.
21	594	R	1961	778-1462		"L" nickel	Specimen consisted of 5 vertically stacked hollow cylinders, each 2.625 in. O.D. and 1 in. high, and having a 0.25 in. bore concentric with the axis.
22	40	L	1956	778-1615	5	"A" nickel	Disk, 7 in. in dia and 1.5 in. thick; density 8.844 g cm^{-3}.
23	276	C	1953	343.2	3	"A" nickel	Cylinder 1.75 in. long and 0.22 in. in dia; density 8.8 g cm^{-3}; Armco iron used as comparative material.
24	675	L, C	1965	323-1123		Electrolytic nickel; Sample 1	< 0.03 Fe, < 0.01 each of Al, Cr, Co, Cu, Mg, Mn, Mo, Si, Sn, Ti, Zn, and Zr, < 0.005 Pb, and < 0.002 B; supplied by The Castner Kellner Alkali Co.; tube of 1.272 cm I.D., 1.908 cm O.D., and 20 cm long, density 8.61 g cm^{-3}; electrical resistivity reported as 7.1, 8.3, 13.0, 19.4, 28.0, 32.8, 36.1, 39.3, 42.4, and 45.2 μohm cm at 293, 323, 423, 523, 623, 723, 823, 923, 1023, and 1123 K, respectively; Armco iron used as comparative material; data taken from smoothed curve.
25	675	L, C	1965	323-823		Electrolytic nickel; Sample 2	Very high purity; supplied by the National Engineering Lab.; tube with 0.634 cm I.D., 2.801 cm O.D., and 19 cm long; density 8.90 g cm^{-3}; electrical resistivity reported as 10.6, 18.5, 23.7, and 33.2 μohm cm at 100, 260, 290, and 500 C, respectively; Armco iron used as comparative material; data taken from smoothed curve.
26	675	L, C	1965	323-823		Electrolytic nickel; Sample 3	99.5 + 0.1 Ni, 0.1-0.2 Co, 0.1-0.2 Si, 0.04 Fe, 0.03 Mg, and 0.01 Cr; supplied by the Atomic Energy Research Establishment in the form of 3 tubes of 1.589 cm O.D., 1.538 cm I.D. and about 43 cm long, 32 strips each 0.95 cm wide and 14 cm long were cut from the tubes and pressed together to form a compact specimen; density 8.9 g cm^{-3}; electrical resistivity reported as 8.3, 9.6, 14.3, 20.6, 29.7, 34.1, and 37.3 μohm cm at 293, 324, 423, 523, 623, 723, and 823 K, respectively; Armco iron used as comparative material; data taken from smoothed curve.
27	675	L, C	1965	323-623		Electrolytic nickel; Sample 4	Commercial nickel; rod 2.54 cm in dia, about 20 cm long; supplied by the Explosives Research and Development Establishment; electrical resistivity reported as 10.1, 11.3, 16.3, 22.8, and 31.5 μohm cm at 293, 323, 423, 523, and 623 K, respectively; Armco iron used as comparative material; data taken from smoothed curve.

SPECIFICATION TABLE NO. 35 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
28	675	L, C	1965	323-1323		Electrolytic nickel; Sample 5	High spectrographic purity; very small impurities of Al, Ca, Cu, Li, Si, Ag, Mg, and Na; supplied by Johnson Matthey Co. (Laboratory No. 4457); rod 0.5 cm in dia and 15 cm long; density 8.91 g cm^{-3}; electrical resistivity reported as 7.1, 8.3, 13.1, 19.4, 28.3, 33.2, 36.4, 39.2, 42.1, 44.7, 47.5, and 49.8 μohm cm at 293, 323, 423, 523, 623, 723, 823, 923, 1023, 1123, 1223, and 1323 K, respectively; Armco iron used as comparative material; data taken from smoothed curve.
29	716	L	1962	4.2, 81		Ni 5011 (I)	Specimen 0.15 cm in dia turned from a cylindrical sample 5.2 cm long; supplied by Johnson Matthey Co.; annealed for 4 hrs at 1273 K in vacuum of 10^{-6} mm Hg, then furnace cooled at a rate of 150 K per hr; electrical resistivity reported as 0.11, 0.676, and 7.16 μohm cm at 4.18, 80.5, and 292 K, respectively; electrical resistivity ratio $\rho(273K)/\rho(4.2K)$ = 60.
30	716	L	1962	4.18	14	Ni 5011 (II)	Specimen 0.19 cm in dia drawn from a cylindrical sample 5.0 cm long; supplied by Johnson Matthey Co.; annealed for 10 hrs at 1573 K in hydrogen and left at 1573 K in a vacuum of 10^{-2} mm Hg for 2 hrs; electrical resistivity reported as 0.0213, 0.60, and 6.35 μohm cm at 4.18, 80.5, and 273.15 K, respectively; $\rho(273K)/\rho(4.2K)$ = 298.
31	34	L	1927	80, 273		Electrolytic nickel	Electrical conductivity reported as 90.2 and 13.05 x 10^4 ohm^{-1} cm^{-1} at 80 and 273 K, respectively.
32	736	L	1965	0.42-0.95	1		Pure.
33	737, 877	E	1965	373-773	± 2	No. 1	99.87 Ni + Co; tube 8.51 mm O.D. and 8.025 mm I.D.; electrical resistivity reported as 7.90, 9.30, 11.50, 17.24, 24.70, 31.84, and 35.36 μohm cm at 20, 50, 100, 200, 300, 400, and 500 C, respectively.
34	737	E	1965	373-748	± 2	No. 2	Tube 12.96 mm O.D. and 11.025 mm I.D.; electrical resistivity reported as 11.60, 17.29, 24.74, 32.01, and 33.98 μohm cm at 100, 200, 300, 400, and 475 C, respectively.
35	743	E	1964	340-920			99.999 pure; specimen 30 cm long and 0.3 cm in dia, annealed in vacuum for 48 hrs at 1173 K; electrical resistivity reported as 8.0, 11.5, 17.0, 24.5, 29.0, 35.0, 38.5, 42.0, 44.0, and 46.0 μohm cm at 40, 105, 210, 305, 375, 485, 590, 720, 780, and 900 C, respectively.
36	846	E	1967	1201-1393			99.95 pure; 14 cm x 1 cm x 0.05cm; obtained from Johnson, Matthey and Co., London; data obtained without heating the ends of the specimen.
37	846	E	1967	1202-1386			99.95 pure; 14 cm x 1 cm x 0.05 cm; obtained from Johnson, Matthey and Co., London; measuring technique improved by heating the ends of the specimen.
38	843	P	1966	298.2			Spherical granular specimen supplied by Linde Co. contained in a 0.75 in. dia x 2 in. long cylindrical cell; mesh size -230 +325; thermal conductivity measured by the transient line source method; measured in Freon-12 under a pressure of ~100 psig.
39	843	P	1966	298.2			Similar to above; measured in argon under a pressure of ~100 psig.

SPECIFICATION TABLE NO. 35 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
40	843	P	1966	298.2			Similar to above; measured in nitrogen under a pressure of ~100 psig.
41	843	P	1966	298.2			Similar to above; measured in methane under a pressure of ~100 psig.
42	843	P	1966	298.2			Similar to above; measured in helium under a pressure of ~100 psig.
43	843	P	1966	298.2			Similar to above; measured in hydrogen under a pressure of ~100 psig.
44	917	E	1965	2.0-90	0.5-5	A	0.0016 impurities (mostly Fe and Si); polycrystalline; 2 mm in dia; obtained from Johnson Matthey and Co.; annealed for 12 hrs at 850 C; electrical resistivity reported as 0.0005998, 0.001197, 0.003741, 0.005248, 0.009616, 0.01675, 0.04624, and 0.0719 μohm cm at 5.5, 8.1, 13.4, 16.1, 20.1, 24.7, 34.4, and 40.0 K, respectively.
45	917	E	1965	5.7-114	0.5-5	B	0.13 Cu; specimen 4 mm in dia; supplied by Johnson Matthey and Co.; chill cast from J.M. 890 Ni and J.M. 30 Cu; annealed for 12 hrs at 850 C.
46	186	P	1928	305.2		A nickel	0.25 cm dia x 35 cm long; density 8.90 g cm^{-3}; thermal conductivity value calculated from measured data of thermal diffusivity, specific heat, and density.

DATA TABLE NO. 35 THERMAL CONDUCTIVITY OF NICKEL

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
31.53	0.478
47.83	0.623
61.97	0.698
76.56	0.746
88.20	0.760
102.40	0.768
117.00	0.779
132.00	0.785
147.00	0.790
161.90	0.793
177.30	0.787
192.20	0.785
206.20	0.783
220.80	0.781
235.20	0.773
254.80	0.763
287.40	0.762
299.60	0.749
CURVE 2	
327.2	0.808
452.2	0.770
558.2	0.686
680.2	0.703
803.2	0.791
949.2	1.113
1016.2	1.163
CURVE 3	
330.2	0.872
352.2	0.866
492.2	0.715
575.2	0.636
687.2	0.597
775.2	0.623
CURVE 4	
362.5	0.723
380.3	0.714
392.8	0.715
CURVE 4 (cont.)	
423.2	0.695
443.2	0.688
457.2	0.670
485.7	0.663
525.0	0.643
532.1	0.636
560.7	0.613
587.5	0.600
705.3	0.579
716.1	0.581
758.9	0.596
780.3	0.603
CURVE 5	
1.98	1.381
2.20	1.576
2.64	1.770
3.10	2.137
3.30	2.460
4.40	2.935
13.60	7.380
15.40	7.770
18.95	8.030
24.00	7.727
27.30	7.273
33.05	5.980
38.10	4.940
56.70	2.845
65.50	2.375
77.65	1.940
91.10	1.705
115.90	1.470
135.50	1.403
CURVE 6	
1.95	0.44
2.20	0.51
2.90	0.66
3.60	0.80
4.40	0.97
4.60	1.00
CURVE 6 (cont.)	
6.20	1.22
8.10	1.60
10.0	2.19
12.4	2.58
14.0	2.90
17.0	3.35
20.7	3.63
22.3	3.86
23.5	3.94
23.6	4.02
26.0	4.00
28.3	3.90
29.6	4.00
31.8	3.95
33.6	3.91
38.0	3.89
44.0	3.76
CURVE 7	
305.2	0.703
CURVE 8	
303.2	0.761
CURVE 9	
295.2	0.618
CURVE 10	
329.2	0.586
CURVE 11	
80.2	1.184
273.2	0.828
CURVE 12	
333.2	0.586
393.2	0.577
CURVE 12 (cont.)	
443.2	0.577
533.2	0.577
598.2	0.565
663.2	0.536
723.2	0.544
763.2	0.544
CURVE 13	
333.2	0.435
423.2	0.431
468.2	0.431
543.2	0.427
633.2	0.410
703.2	0.418
753.2	0.418
CURVE 14	
343.2	0.285
358.2	0.259
393.2	0.293
468.2	0.285
518.2	0.285
603.2	0.276
683.2	0.272
703.2	0.264
763.2	0.301
783.2	0.301
853.2	0.318
893.2	0.318
983.2	0.318
1073.2	0.318
CURVE 15	
1093.2	0.80
1102.2	0.81
1108.2	0.70
1113.2	0.73
1183.2	0.95
1193.2	0.71
1193.2	0.78
1263.2	0.80
CURVE 16	
295.2	0.669
CURVE 17	
304.5	0.816
308.3	0.816
312.1	0.811*
315.9	0.800
319.3	0.802*
323.2	0.801
CURVE 18*	
303.2	0.829
307.3	0.828
310.2	0.815
313.9	0.819
317.0	0.815
CURVE 19*	
301.9	0.826
304.1	0.825
306.2	0.828
306.4	0.809
313.2	0.796
316.2	0.798
320.2	0.797
CURVE 20*	
305.2	0.831
308.2	0.829
309.3	0.834
314.7	0.812
317.7	0.819
320.7	0.822
CURVE 21	
777.6	0.568
814.8	0.576
842.6	0.533
919.8	0.604
CURVE 21 (cont.)	
1070.4	0.644
1083.2	0.647*
1092.6	0.649*
1103.4	0.652
1205.4	0.678
1380.4	0.723
1461.5	0.744
CURVE 22	
778	0.488
815	0.505
842.6	0.504
920	0.551
1088	0.583
1205	0.600
1380	0.651
1460	0.690
1616	0.719
CURVE 23	
343.2	0.636
CURVE 24	
323	0.822
423	0.738
523	0.655
623	0.573
723	0.588*
823	0.612
923	0.637
1023	0.662
1123	0.687
CURVE 25	
323	0.875
423	0.777
523	0.697
623	0.633
723	0.632
823	0.652
CURVE 26*	
323	0.800
423	0.731
523	0.669
623	0.611
723	0.632
823	0.652
CURVE 27	
323	0.657
423	0.616
523	0.581
623	0.547
CURVE 28	
323	0.837*
423	0.766*
523	0.701*
623	0.640*
723	0.658
823	0.679
923	0.701
1023	0.723
1123	0.745*
1223	0.766
1323	0.786
CURVE 29	
4.18	0.909
80.5	1.78
CURVE 30	
4.18	4.42
CURVE 31	
80	1.11
273	0.839
CURVE 32	
0.423	0.105
0.435	0.110
0.445	0.113
0.453	0.115
0.490	0.115
0.500	0.120
0.518	0.125
0.548	0.133
0.560	0.131
0.575	0.136
0.595	0.145
0.610	0.150
0.620	0.153
0.643	0.160
0.650	0.163
0.680	0.171
0.735	0.184
0.750	0.184
0.765	0.185
0.785	0.183
0.795	0.188
0.828	0.196
0.905	0.208
0.915	0.220
0.938	0.228
0.945	0.230
CURVE 33	
373.2	0.873
423.2	0.828
473.2	0.774
498.2	0.751
523.2	0.728
548.2	0.704
573.2	0.680
598.2	0.660
623.2	0.643*
648.2	0.633
673.2	0.630
698.2	0.630
723.2	0.630*
748.2	0.632
773.2	0.634

* Not shown on plot

DATA TABLE NO. 35 (continued)

CURVE 34

T	k
373.2	0.743
423.2	0.726
473.2	0.695
498.2	0.690
523.2	0.675
548.2	0.660
573.2	0.644
598.2	0.629
623.2	0.615
648.2	0.614
673.2	0.612
698.2	0.615
723.2	0.618
748.2	0.621

CURVE 35

T	k
340	1.04
408	0.887
519	0.761
603	0.678
613	0.686
638	0.661
668	0.678
688	0.690
718	0.711
768	0.724
840	0.745
883	0.720
920	0.732

CURVE 36

T	k
1201	0.490
1234	0.569
1279	0.602
1306	0.661
1357	0.674
1393	0.753

CURVE 37

T	k
1202	0.753
1231	0.761
1274	0.812
1314	0.883
1386	0.967

CURVE 38*

T	k
298.2	0.00197

CURVE 39*

T	k
298.2	0.00280

CURVE 40*

T	k
298.2	0.00349

CURVE 41

T	k
298.2	0.00414

CURVE 42*

T	k
298.2	0.0123

CURVE 43*

T	k
298.2	0.0149

CURVE 44

T	k
2.0	0.80
3.3	1.57
4.6	1.94
4.6	2.07
6.3	2.70
7.8	3.35
8.3	3.58
10.1	4.25
10.2	4.32
11.7	4.80
11.9	4.88
13.6	5.29
13.6	5.34*
13.9	5.31

CURVE 44 (cont.)

T	k
14.3	5.44
14.9	5.68
15.8	5.85
16.2	5.79
17.5	5.96
18.0	6.04
18.5	6.15
18.8	6.21
19.1	6.20*
19.8	6.27
20.3	6.23
20.3	6.31
21.6	6.34
21.8	6.29*
22.4	6.25
23.7	6.34
24.3	6.35
24.6	6.30
25.1	6.24
25.3	6.13*
27.5	6.01
30.9	5.77
30.2	5.72*
32.8	5.34
34.8	5.05
40.1	4.33
44.8	3.72
45.1	3.79
49.2	3.26
50.1	3.26
58.0	2.72
71.6	2.04
90.1	1.60

CURVE 45

T	k
5.7	0.73
7.9	1.01
9.9	1.32
12.1	1.57
14.1	1.78
15.0	1.92
16.4	2.04
18.6	2.2[illegible]
22.4	2.47

CURVE 45 (cont.)

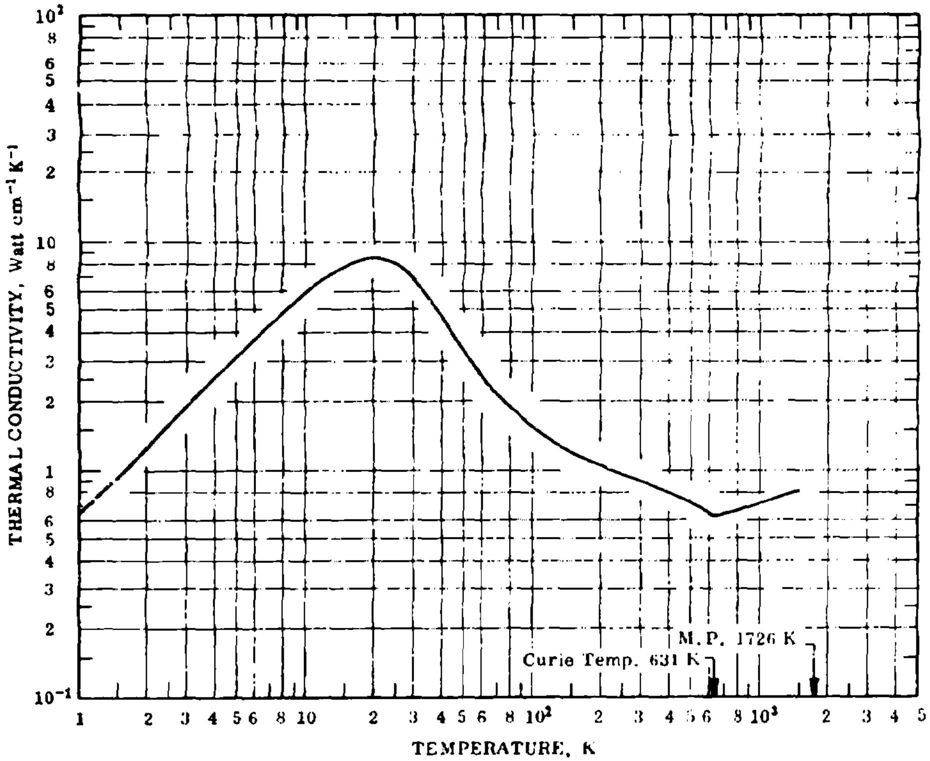
T	k
26.0	2.57
27.7	2.58
30.9	2.56
37.3	2.54
59.0	2.03
62.3	1.90
64.7	1.87
73.5	1.68
82.0	1.55
98.4	1.35
106.4	1.27
113.9	1.23

CURVE 46*

T	k
305.2	0.615

* Not shown on plot

FIGURE AND TABLE NO. 35R   RECOMMENDED THERMAL CONDUCTIVITY OF NICKEL



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	600	0.655	37.8	620.3
1	(0.64)‡	(37.0)	-457.9	631	0.638	36.9	676.1
2	1.27	73.4	-456.1	700	0.653	37.7	800.3
3	1.91	110	-454.3	800	0.674	38.9	980.3
4	2.54	147	-452.5	900	0.696	40.2	1160
5	3.16	183	-450.7	1000	0.718	41.5	1340
6	3.77	218	-448.9	1100	0.739	42.7	1520
7	4.36	252	-447.1	1200	0.761	44.0	1700
8	4.94	285	-445.3	1300	0.782	45.2	1880
9	5.49	317	-443.5	1400	0.804	46.5	2060
10	6.00	347	-441.7	1500	0.825	47.7	2240
11	6.48	374	-439.9				
12	6.91	399	-438.1				
13	7.30	422	-436.3				
14	7.64	441	-434.5				
15	7.92	458	-432.7				
16	8.15	471	-430.9				
18	8.45	488	-427.3				
20	8.56	495	-423.7				
25	8.15	471	-414.7				
30	6.95	402	-405.7				
35	5.62	325	-396.7				
40	4.63	268	-387.7				
45	3.91	226	-378.7				
50	3.36	194	-369.7				
60	2.63	152	-351.7				
70	2.21	128	-333.7				
80	1.93	112	-315.7				
90	1.72	99.4	-297.7				
100	1.58	91.3	-279.7				
150	1.21	69.9	-189.7				
200	1.06	61.2	- 99.7				
250	0.97	56.0	- 9.7				
273.2	0.94	54.3	32.0				
300	0.905	52.3	80.3				
350	0.850	49.1	170.3				
400	0.801	46.3	260.3				
500	0.721	41.7	440.3				

REMARKS

The recommended values are for well-annealed 99.99$^+$% pure nickel with residual electrical resistivity ρ_0 = 0.0384 $\mu\Omega$ cm (characterization by ρ_0 becomes important below room temperature). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, α' = 9.57 x 10^{-5}, and β = 1.57. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature, and 5 to 10% at other temperatures.

* T_1 in K, k_1 in Watt $cm^{-1} K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$.   ‡ Values in parentheses are extrapolated.

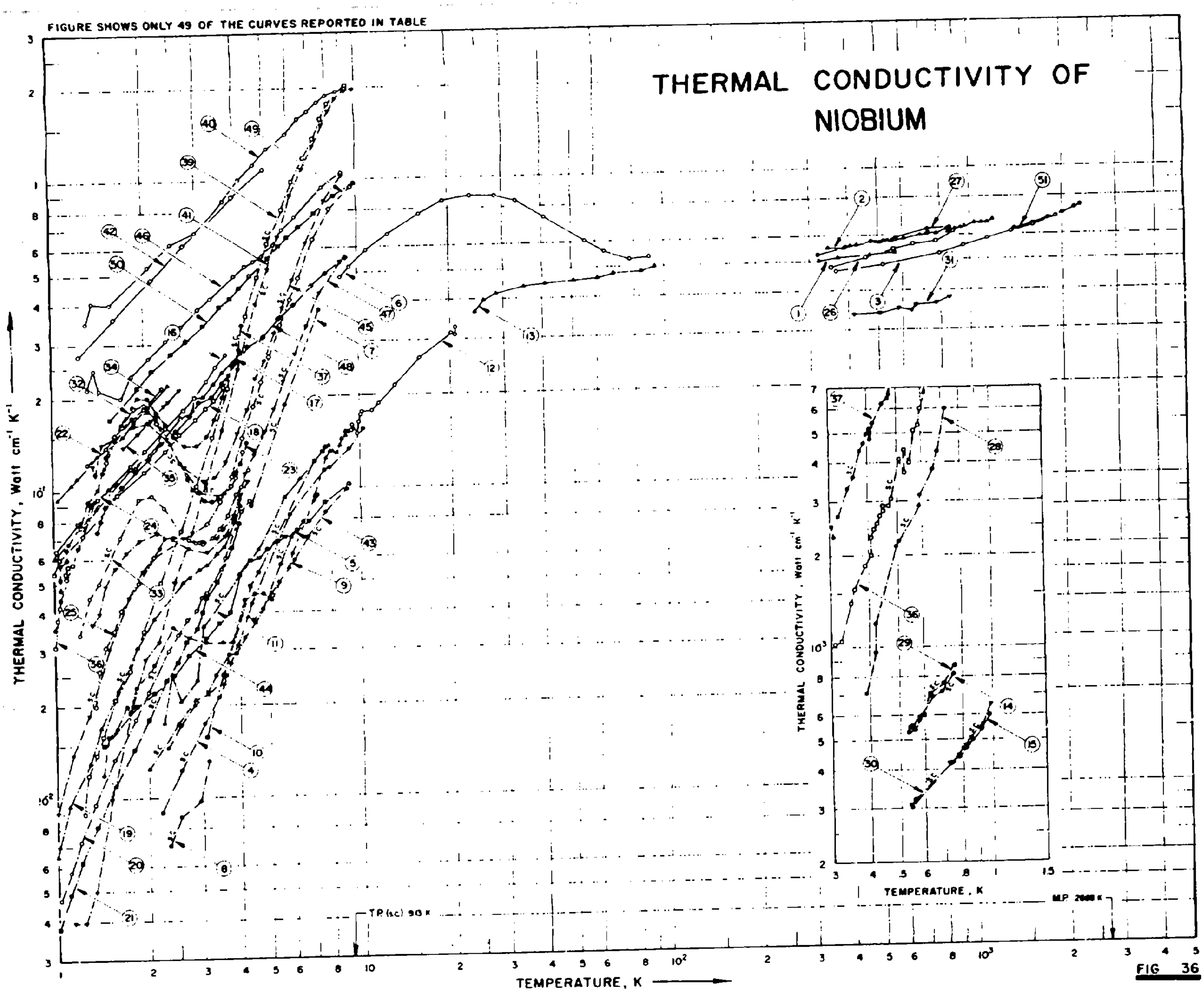


FIGURE SHOWS ONLY 49 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF NIOBIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
TP (sc) 9.0 K
M.P. 2686 K

FIG 36

SPECIFICATION TABLE NO. 36 THERMAL CONDUCTIVITY OF NIOBIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 36]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	652	C	1961	323-573			< 0.1 Ta, 0.015 Ti, < 0.01 C, < 0.01 Fe, < 0.01 N, < 0.01 O, and < 0.01 Si; ~6 mm dia x 10 cm long; manufactured by Murex Ltd; sintered above 2000 C and cold swaged; electrical resistivity reported as 15.0, 16.5, 18.7, 23.2, and 27.7 μohm cm at 293, 323, 373, 473, and 573 K, respectively; Armco iron used as comparative material.
2	728	P	1965	345-1195			99.95 Nb, 0.011 O, 0.005 C, 0.0027 N, and 0.0006 H; specimen 0.25 in. in dia and 2 in. long; obtained from Kawecki Chemical Co.; refined by electron beam melting, annealed and machined to size; density 8.61 g cm^{-3}; electrical resistivity reported as 15.2, 28.2, 39.1, and 49.3 μohm cm at 300, 600, 900, and 1200 K, respectively; thermal conductivity values calculated from measured data of thermal diffusivity and specific heat data taken from Jaeger, F.M. and Veenstra, W.A. (Rec. Trav. Chim., 53, 677, 1934).
3	39	R	1958	365-1911			High purity; specimen consisted three stacked disks each of 0.625 in. I.D., 3.0 in. O.D., and 1 in. thick.
4	96	L	1950	2.2-10	2.0-5.0		High purity; in normal state; measured in a magnetic field.
5	96	L	1950	2.3-7.3	2.0-5.0		High purity; in superconducting state.
6	151	L	1957	8.9-90		Nb 5	99.9 pure; wire drawn from a rod of ductile niobium 1.59 mm dia obtained from Fansteel Metallurgical Corp; ideal electrical resistivity reported as 0.038, 0.084, 0.25, 0.53, 0.97, 2.36, 3.90, 7.0, 9.8, 12.3, 13.5, and 14.5 μohm cm at 15, 20, 30, 40, 50, 75, 100, 150, 200, 250, 273, and 295 K, respectively; residual electrical resistivity 0.475 μohm cm; transition temp 9.25 K; in normal state.
7	151	L	1957	4.4-7.5		Nb 5	The above specimen measured in superconducting state.
8	97	L	1952	2.3-3.1	2.0-3.0	JM 4526; Nb 1	99.99 pure; polycrystalline; magnetic field "frozen in"; in superconducting state; measured after removing the applied magnetic field.
9	97	L	1952	2.0-9.2	2.0-3.0	Nb 1	The above specimen in superconducting state; measured before applying any magnetic field.
10	97	L	1952	3.1-7.8	2.0-3.0	Nb 1	The above specimen measured in a field of 2300 gauss; assumed in superconducting state below 6 K and in normal state above 6 K.
11	97	L	1952	2.3-7.9	2.0-3.0	Nb 1	The above specimen measured in a field of 3300 gauss; assumed in superconducting state below 5 K and in normal state above 5 K.
12	97	L	1952	9.5-21	2.0-3.0	Nb 1	The above specimen in normal state.
13	122	L	1955	24-94	3.0	JM 4526; Nb 1	99.99 pure; polycrystalline; 0.470 cm dia x 3.03 cm long; electrical resistivity reported as 0.145, 0.149, 0.153, 0.166, 0.183, 0.220, 0.276, 0.319, 0.416, and 0.462 μohm cm at 20.6, 23.4, 26.2, 31.7, 38.9, 47.7, 59.2, 67.1, 82.9, and 90.0 K, respectively.
14	400	L	1953	0.54-0.75		Nb 1	99.99 pure; polycrystalline; magnetic field "frozen in"; in superconducting state; measured after removing the applied magnetic field.

SPECIFICATION TABLE NO. 36 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
15	400	L	1953	0.55-0.97		Nb 1	99.99 pure; polycrystalline; in superconducting state; measured before applying the magnetic field.
16	389	L	1958	1.0-3.7			Rod specimen; in normal state.
17	389	L	1958	1.0-4.2			The above specimen bent to 5-13.4% strained; in normal state.
18	389	L	1958	1.0-3.7			The above specimen bent to 19.5% strained; in normal state.
19	389, 676	L	1958	0.97-4.2			Single crystal; rod specimen; zone refined; not intentionally annealed; bent to 5.1% strained; in superconducting state.
20	389, 676	L	1958	1.0-4.4			The above specimen bent to 13.4% strained; in superconducting state.
21	389, 676	L	1958	0.87-4.1			The above specimen bent to 19.5% strained; in superconducting state.
22	389, 501	L	1958	1.0-2.4		Nb II	0.0003 Cu and 0.0003 Mg; single crystal; specimen made by floating zone melting of polycrystalline rod; in normal state (data reported in Ref. 389 are 10 times higher than those reported in Ref. 501 and the latter are used).
23	389, 501	L	1958	1.0-4.3		Nb II	The above specimen in superconducting state (data reported in Ref. 389 are 10 times higher than those reported in Ref. 501 and the latter are used).
24	389, 501	L	1958	1.0-3.0		Nb I	Similar to the above specimen; not intentionally annealed; in normal state (data reported in Ref. 389 are 10 times higher than those reported in Ref. 501 and the latter are used).
25	389, 501, 676	L	1958	1.0-4.3		Nb I	The above specimen in superconducting state (data reported in Ref. 389 are 10 times higher than those reported in Ref. 501 and the latter are used).
26	413, 138	L	1955	353-888			99.95 Nb and < 0.05 O; rectangular specimen; density 8.38 g cm^{-3}; electrical resistivity reported as 16.41, 20.85, 25.22, 29.74, 34.19, 38.63, 43.07, and 45.30 μohm cm at 0, 100, 200, 300, 400, 500, 600, and 650 C, respectively.
27	413, 138	L	1955	323-856			99.95 Nb and < 0.05 O; cylindrical specimen; density 8.65 g cm^{-3}; electrical resistivity reported as 15.22, 19.18, 23.13, 27.09, 31.04, 35.00, and 38.96 μohm cm at 0, 100, 200, 300, 400, 500, and 600 C, respectively.
28	412	L	1955	0.39-0.72		JM 4526	99.99 pure; polycrystalline; measured with magnetic shielding; in superconducting state.
29	412	L	1955	0.54-0.76			The above specimen measured without magnetic shielding; in superconducting state.
30	412	L	1955	0.54-0.99			Same as above, 2nd run.
31	606	L	1954	417-853			Density 7.73 g cm^{-3}; electrical resistivity reported as 31.25, 35.78, 40.30, 44.83, 49.35, 53.88, and 58.40 μohm cm at 0, 100, 200, 300, 400, 500, and 600 C, respectively.

SPECIFICATION TABLE NO. 36 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
32	677	L	1960	1.1-4.2			Single crystal; 4 mm in dia and 50 mm long; prepared by the "floating zone" technique in an electron bombardment furnace; in superconducting state.
33	677	L	1960	1.2-4.4			The above specimen irradiated by a dose of 10^{18} fast neutrons cm^{-2} at 30 ±5 C, then allowed a few weeks for radioactivity to decay; in superconducting state.
34	677	L	1960	1.3-2.3			The above specimen before irradiation; in normal state; measured in a magnetic field.
35	677	L	1960	1.7-2.6			The above irradiated specimen (curve 33) in normal state; measured in a magnetic field.
35	705	L	1962	0.26-1.2	5	Nb II	0.0003 Cu and 0.0003 Mg; single crystal; dia 4.0 mm; ratio of length to cross sectional area 25.7 cm^{-1}, obtained by the floating zone melting of polycrystalline rod of niobium in vacuum; electrical resistivity ratio $\rho(298K)/\rho_0 = 60.5$; in superconducting state.
37	705	L	1962	0.25-4.2	5	Nb III	Dia 2.2 mm, ratio of length to cross sectional area 89.6 cm^{-1}; electrical resistivity ratio $\rho(298K)/\rho_0 = 120.0$; in superconducting state.
38	724	L, C	1957	373, 473		Sample B	0.1 Ta; electrical resistivity reported as 16.2, 19.5, and 23.5 μohm cm at 20, 100, and 200 C, respectively; Armco iron used as comparative material.
39	847	L	1966	1.2-9.4	10	Nb I	0.03 Al, 0.03 Fe, 0.02 Si, 0.01 C, < 0.01 Cl, < 0.01 Cr, < 0.01 Pb, and < 0.01 Mn; single crystal; 2.34 mm in dia and 20 mm long; supplied by Johnson Matthey and Co.; obtained by fusion in a floating zone by electronic bombardment; residual electrical resistivity 0.09 μohm cm; transition temp 9.5 K; in superconducting state.
40	847	L	1966	1.3-9.4	10	Nb I	The above specimen in normal state.
41	847	L	1966	1.1-9.9	10	Nb I	The above specimen irradiated by 5.6 x 10^{17} fast neutrons cm^{-2}; residual electrical resistivity 0.11 μohm cm; in superconducting state.
42	847	L	1966	1.2-5.0	10	Nb I	The above specimen in normal state.
43	847	L	1966	1.4-9.0	10	Nb I	The above specimen annealed at 1870 C in a vacuum of 5 x 10^{-6} torr for 63 hrs; residual electrical resistivity 2.48 μohm cm; in superconducting state.
44	847	L	1966	1.4-9.2	10	Nb I	The above specimen in normal state.
45	847	L	1966	1.3-9.0	10	Nb III DA	0.1 Ta, 0.01 Ti, 0.007 Fe, 0.005 Cu, 0.005 N, 0.005 O, 0.003 Na, 0.002 Al, 0.002 C, 0.002 Si, and 0.001 H; single crystal; 5.10 mm in dia and 21 mm long; made from polycrystalline sample of Pechiney; annealed at 1350 C in a vacuum of < 10^{-6} torr for 3 min; residual electrical resistivity 0.21 μohm cm; transition temp 9.25 K; in superconducting state.
46	847	L	1966	1.3-9.0	10	Nb III DA	The above specimen in normal state.

SPECIFICATION TABLE NO. 36 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
47	847	L	1966	1.3-8.8	10	Nb IV AA	Single crystal; 2.96 mm in dia and 21 mm long; supplied by Kuhlmann; annealed at 1320 C by electron bombardment for 15 min in a vacuum of $< 10^{-6}$ torr; residual electrical resistivity $\rho_0 = 0.38$ μohm cm; transition temp 9.25 K; in superconducting state.
48	847	L	1966	1.4-9.2	10	Nb IV AA	The above specimen in normal state.
49	847	L	1966	1.3-9.6	10	Nb IV B	Single crystal; 2.96 mm in dia and 21 mm long; supplied by Kuhlmann; obtained by fusion in a floating zone; residual electrical resitivity 0.22 μohm cm; transition temp 9.25 K; in superconducting state.
50	847	L	1966	1.5-9.9	10	Nb IV B	The above specimen in normal state.
51	848	E	1966	1400-2300	± 2		99.7 Nb + Ta, 0.17 Ta, 0.06 Si, 0.03 Fe, and 0.025 Ti; cylindrical specimen 65 mm long and 14 mm in dia finished to an "eighth-class" surface (max height of asperities 2.2 μ); preheated at 2000 to 2200 K for 4 hrs; density 8.56 g cm^{-3}; measured in a vacuum of 5×10^{-6} mm Hg.

DATA TABLE NO. 36 THERMAL CONDUCTIVITY OF NIOBIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
323.2	0.50
373.2	0.51
473.2	0.52
573.2	0.53
CURVE 2	
345	0.545
390	0.545*
395	0.550*
410	0.555
430	0.560
510	0.570*
525	0.575*
555	0.575*
570	0.580*
610	0.585
690	0.600
725	0.605
780	0.610
840	0.630
855	0.615
895	0.630*
935	0.635*
965	0.640
1040	0.660
1095	0.660
1140	0.660
1195	0.675
CURVE 3	
364.8	0.466
521.1	0.486
798.1	0.521
958.2	0.552
1154.7	0.583
1374.3	0.614
1617.2	0.642
1910.7	0.689
CURVE 4	
2.20	0.0090
2.55	0.0124
3.05	0.0175
3.40	0.0212
3.55	0.0234
3.73	0.0272
3.95	0.0313
4.40	0.0427
5.90	0.0830
7.70	0.115
8.00	0.117
9.27	0.135
10.35	0.157
CURVE 5	
2.30	0.0146
2.55	0.0174
2.83	0.0200
3.13	0.0220
3.32	0.0250
3.67	0.0290
3.90	0.0294
4.1[illegible]	0.0330
4.5[illegible]	0.0370
4.7[illegible]	0.0410
5.45	0.0570
5.97	0.0700
6.52	0.0785
7.30	0.0950
CURVE 6	
8.85	0.483
9.42	0.520
10.77	0.582
12.70	0.660
16.00	0.767
19.23	0.842
23.65	0.870
28.50	0.865
33.30	0.835
41.00	0.736
CURVE 6 (cont.)	
55.80	0.608
64.40	0.560
77.90	0.528
90.00	0.534
CURVE 7	
4.42	0.089
5.77	0.189
7.50	0.380
CURVE 8	
2.33	0.00700
2.53	0.00875
2.93	0.00975
3.13	0.0133
CURVE 9	
2.00	0.0125
2.50	0.0175
2.85	0.0208
3.15	0.0218
3.60	0.0248
4.25	0.0388
4.45	0.0375
5.00	0.0445
5.08	0.046
5.85	0.0555
6.00	0.0618
7.13	0.0945
7.80	0.126
8.00	0.133
8.13	0.133
8.48	0.130
8.63	0.138
8.80	0.145
9.03	0.148
9.03	0.152*
9.18	0.152
CURVE 10	
3.08	0.0158
3.50	0.0250
4.35	0.0483
4.63	0.0538
7.13	0.122
7.60	0.131
7.83	0.136
CURVE 11	
2.25	0.0175
2.38	0.0253
2.55	0.0205
2.88	0.0240
3.05	0.0360
4.65	0.0640
5.68	0.0938
6.38	0.107
7.88	0.136*
7.90	0.138
CURVE 12	
9.48	0.154
9.50	0.160
9.83	0.150
10.0	0.164
10.1	0.172
10.3	0.177
11.1	0.179
11.6	0.188
13.2	0.214
15.8	0.261
20.3	0.314
20.6	0.301
20.9	0.327
CURVE 13	
24.17	0.365
25.83	0.397
28.33	0.418
CURVE 13 (cont.)	
34.90	0.439
41.04	0.448
51.04	0.454
60.62	0.461
68.54	0.479
84.60	0.484
93.75	0.499
CURVE 14	
0.535	0.00053
0.560	0.00054
0.580	0.00058
0.590	0.00060
0.640	0.00069
0.685	0.00072
0.748	0.00982
CURVE 15	
0.545	0.000302
0.555	0.00032
0.728	0.00042*
0.74	0.00043*
0.78	0.00044
0.82	0.00047
0.83	0.000485
0.86	0.00050*
0.88	0.00051*
0.92	0.00054
0.97	0.00060
CURVE 16	
1.02	0.062
1.22	0.077
1.41	0.089
1.80	0.118
2.08	0.131
2.35	0.160
2.69	0.182
3.21	0.225
3.43	0.250
3.70	0.275
CURVE 17	
1.00	0.061
1.298	0.082
1.52	0.101
1.86	0.119
2.21	0.141
2.64	0.173
2.88	0.183
2.92	0.199
3.10	0.200
3.38	0.220
3.60	0.240
4.16	0.276
CURVE 18	
0.999	0.054
1.04	0.060
1.62	0.097
1.98	0.115
2.34	0.134
2.60	0.152
2.95	0.170
3.18	0.184
3.39	0.195
3.65	0.215
CURVE 19	
0.970	0.00600*
1.00	0.00650
1.02	0.00700
1.10	0.00950
1.29	0.0131
1.40	0.0170
1.60	0.0225
1.85	0.0308
2.10	0.0385
2.63	0.0500
2.76	0.0520
2.98	0.0550
3.15	0.0570
3.40	0.0620
3.59	0.0655
3.75	0.0722
CURVE 19 (cont.)	
3.90	0.0790
4.09	0.0890
4.23	0.102*
CURVE 20	
1.02	0.00470
1.10	0.00580
1.19	0.00725
1.33	0.00960
1.55	0.0135
1.82	0.0180
2.00	0.0220
2.34	0.0300
2.51	0.0340
2.70	0.0380
2.90	0.0408
3.03	0.0448
3.13	0.0462
3.50	0.0550
3.60	0.0600
4.10	0.0850
4.39	0.0920
CURVE 21	
0.870	0.00337*
1.00	0.00380
1.10	0.00490
1.19	0.00620
1.35	0.00815
1.55	0.0110
1.79	0.0145
2.00	0.0180
2.30	0.0240
2.50	0.0275
2.67	0.0320
2.90	0.0355
3.02	0.0400
3.13	0.0445
3.40	0.0500
3.80	0.0650
4.03	0.0780*
4.13	0.0850

* Not shown on plot

DATA TABLE NO. 36 (continued)

CURVE 22

T	k
1.03	0.0940
1.15	0.105
1.20	0.110
1.40	0.130
1.69	0.150
1.85	0.168
2.05	0.187
2.39	0.216

CURVE 23

T	k
0.997	0.0355
1.05	0.0445
1.20	0.0660
1.32	0.0906
1.61	0.146
1.82	0.173
2.05	0.181
2.18	0.174
2.42	0.141
2.60	0.122
2.75	0.109
2.85	0.100
2.96	0.0981
3.11	0.0925
3.30	0.0915
3.46	0.0935
3.61	0.0971
3.99	0.113
4.05	0.121
4.30	0.141

CURVE 24

T	k
1.02	0.0640
1.20	0.0790
1.40	0.0940
1.80	0.119
2.01	0.135
2.36	0.160
2.70	0.182
2.95	0.200

CURVE 25

T	k
1.00	0.00900
1.14	0.0140
1.28	0.0187
1.51	0.0305
1.74	0.0450
1.95	0.0550
2.21	0.0650
2.31	0.0700
2.45	0.0702
2.64	0.0700
2.75	0.0695
2.84	0.0690
3.06	0.0680
3.40	0.0700
3.59	0.0750
3.87	0.0825
4.03	0.0925
4.31	0.107

CURVE 26

T	k
353.2	0.477
463.2	0.510
568.2	0.540
656.2	0.561
778.2	0.573
888.2	0.619

CURVE 27

T	k
323.2	0.524
478.2	0.574
578.2	0.587
726.2	0.628
856.2	0.636

CURVE 28

T	k
0.39	0.00071
0.42	0.00096
0.42	0.0012
0.495	0.00215
0.505	0.00224
0.59	0.00290
0.595	0.00315
0.655	0.00380
0.680	0.00435
0.720	0.00600

CURVE 29

T	k
0.54	0.00055
0.55	0.000555*
0.58	0.00059*
0.595	0.00060*
0.630	0.000705
0.695	0.00076
0.755	0.00087

CURVE 30

T	k
0.540	0.000305
0.555	0.000315
0.725	0.00042
0.740	0.000425
0.780	0.000445
0.810	0.00047
0.820	0.00048
0.850	0.000505
0.930	0.00056
0.99	0.00065

CURVE 31

T	k
417.2	0.334
505.2	0.338
583.2	0.348
643.2	0.343
669.2	0.357
778.2	0.364
853.2	0.376

CURVE 32

T	k
1.10	0.0520
1.24	0.0720
1.50	0.124
1.60	0.151
1.86	0.185
2.00	0.189
2.20	0.166*
2.60	0.122*
3.00	0.098*
3.53	0.095*
3.80	0.102
3.94	0.109
4.18	0.132

CURVE 33

T	k
1.20	0.0340
1.30	0.0450
1.40	0.0500
1.64	0.0710
1.90	0.0940
2.10	0.0960
2.30	0.0880*
2.68	0.0700*
2.90	0.0680*
3.06	0.0670*
3.30	0.0700
3.48	0.0750
3.70	0.0830
3.95	0.0960
4.11	0.102
4.37	0.116

CURVE 34

T	k
1.30	0.122
1.50	0.138
1.70	0.163
2.00	0.185*
2.30	0.215

CURVE 35

T	k
1.70	0.138
1.90	0.153
2.10	0.170
2.32	0.189
2.40	0.195
2.61	0.212

CURVE 36

T	k
0.260	0.00079
0.265	0.00083
0.275	0.00086
0.300	0.00101
0.310	0.00103
0.325	0.00105
0.350	0.00140
0.360	0.00155
0.390	0.00185
0.410	0.00200
0.410	0.00230
0.420	0.00245*
0.430	0.00255*
0.44	0.00270
0.45	0.00290
0.45	0.00280
0.47	0.00290
0.48	0.00305
0.51	0.00410
0.53	0.00370
0.53	0.00440
0.55	0.0040
0.57	0.0051
0.59	0.0053
0.60	0.0060
0.66	0.0095
0.68	0.0105
0.73	0.0120
0.76	0.0125
0.77	0.0138
0.78	0.0155
0.82	0.0165
0.84	0.0180
0.85	0.0190
0.89	0.0215
0.90	0.0230
0.92	0.0270
0.95	0.0285
0.98	0.040
1.00	0.031
1.01	0.038
1.04	0.042
1.08	0.054
1.10	0.057
1.11	0.057*
1.15	0.058

CURVE 37

T	k
0.245	0.00145
0.255	0.00150
0.255	0.00165
0.285	0.00200
0.285	0.00215
0.300	0.00220
0.305	0.00250
0.310	0.00230
0.320	0.00270
0.345	0.00330
0.360	0.00360
0.380	0.00440
0.390	0.00465
0.400	0.0050
0.410	0.00520
0.410	0.00480
0.420	0.00540
0.450	0.00625
0.470	0.00650
0.480	0.00725
0.490	0.00775
0.490	0.00800
0.510	0.00850
0.540	0.0100
0.540	0.0105
0.550	0.0110
0.560	0.0102
0.590	0.0130
0.600	0.0145
0.630	0.0145
0.650	0.0160
0.67	0.0165
0.68	0.0160
0.71	0.0210
0.73	0.0220
0.82	0.0340
0.83	0.0320
0.86	0.0330
0.87	0.0350
0.88	0.0370
0.89	0.0330
0.90	0.0350
0.95	0.0430
0.97	0.0460
0.97	0.0430
0.98	0.0490
1.05	0.0480
1.05	0.0520
1.05	0.0580
1.10	0.0601
1.10	0.0650
1.12	0.0680
1.23	0.0780*
1.30	0.0925
1.40	0.102
1.45	0.115
1.50	0.130
1.60	0.148*
1.68	0.165
1.90	0.200
2.05	0.200
2.20	0.180
2.35	0.165
2.50	0.150
2.70	0.140
2.95	0.140
3.20	0.150
3.40	0.170
3.60	0.200
3.80	0.235
3.90	0.250
4.10	0.285
4.20	0.340

CURVE 38*

T	k
373.2	0.506
473.2	0.527

CURVE 39

T	k
1.22	0.009
1.26	0.012
1.35	0.014
1.41	0.016
1.55	0.021
1.74	0.026
1.94	0.035
2.21	0.050
2.59	0.074
2.93	0.103
3.33	0.148
3.75	0.212
4.31	0.362
4.73	0.485
5.13	0.615
5.72	0.803
6.20	0.981
6.76	1.176
7.26	1.375
7.75	1.579
8.21	1.758
8.80	1.919
9.39	2.017

* Not shown on plot

DATA TABLE NO. 36 (continued)

CURVE 40

T	k
1.30	0.347
1.36	0.402
1.56	0.397
2.08	0.529
2.48	0.620
2.97	0.678
3.67	0.861
4.16	1.000
4.67	1.126
5.17	1.285
5.93	1.435
6.51	1.596
7.05	1.670
7.61	1.782
8.11	1.877
8.76	1.938
9.36	1.981

CURVE 41

T	k
1.12	0.004
1.22	0.004
1.32	0.005
1.50	0.010
1.76	0.020
1.95	0.028
2.16	0.032
2.45	0.050
2.82	0.073
3.15	0.104
3.57	0.156
4.35	0.242
4.67	0.392
5.11	0.513
5.54	0.647
6.12	0.886
6.72	1.080
7.21	1.295
7.77	1.502
8.23	1.660
8.73	1.820
9.31	1.931
9.91	1.958

CURVE 42

T	k
1.23	0.273
1.60	0.357
2.13	0.480
2.73	0.613
3.95	0.885
5.01	1.087

CURVE 43

T	k
1.41	0.012
1.47	0.016
1.57	0.017
1.69	0.020
1.73	0.019
1.83	0.023
2.08	0.027
2.41	0.036
2.72	0.033
3.10	0.032
3.50	0.032
3.78	0.032
4.14	0.044
4.47	0.046
4.79	0.046
5.06	0.044
5.40	0.050
6.05	0.059
6.72	0.070
7.68	0.084
9.00	0.099

CURVE 44

T	k
1.42	0.015
1.49	0.016*
1.60	0.017*
1.70	0.019*
1.83	0.020
2.08	0.022
2.41	0.025
2.71	0.029
3.09	0.033
3.41	0.037
3.71	0.040
4.01	0.053
4.33	0.059
4.65	0.060

CURVE 44 (cont.)

T	k
4.95	0.064
5.34	0.068
5.66	0.070
6.13	0.073
6.75	0.079
7.67	0.090
9.15	0.103

CURVE 45

T	k
1.34	0.121
1.37	0.113
1.44	0.141
1.66	0.152*
1.84	0.162
2.06	0.166
2.35	0.148
2.67	0.119
3.09	0.106
3.36	0.109
3.66	0.122
4.00	0.152
4.34	0.181
4.63	0.228
4.93	0.259
5.31	0.318
5.70	0.382
6.13	0.472
6.85	0.619
7.89	0.851
8.99	1.021

CURVE 46

T	k
1.31	0.212
1.37	0.245
1.43	0.211
1.67	0.198
1.83	0.235
2.07	0.267
2.38	0.305
2.66	0.337
3.03	0.382
3.32	0.414
3.97	0.491
4.33	0.527
4.64	0.544

CURVE 46 (cont.)

T	k
4.95	0.565*
5.37	0.613
5.73	0.690
6.30	0.764
7.77	0.944
9.03	1.053

CURVE 47

T	k
1.33	0.037
1.39	0.040
1.46	0.049
1.57	0.056
1.71	0.063
1.89	0.069
2.17	0.073
2.43	0.070
2.74	0.065
3.15	0.063
3.61	0.071
3.86	0.081
4.22	0.112
4.54	0.129
4.92	0.154
5.29	0.182
5.73	0.223
6.25	0.273
6.80	0.335
7.53	0.429
8.81	0.536

CURVE 48

T	k
1.38	0.074
1.42	0.080
1.48	0.089
1.55	0.101*
1.67	0.103
1.86	0.116
2.05	0.127
2.26	0.142
2.52	0.156
2.82	0.174
3.00	0.192
3.30	0.199
3.59	0.220
3.99	0.259

CURVE 48 (cont.)

T	k
4.38	0.290
4.91	0.310
5.52	0.355
6.17	0.392
7.06	0.454
7.87	0.496
9.19	0.555

CURVE 49

T	k
1.34	0.020
1.38	0.026
1.46	0.031
1.56	0.035
1.64	0.041
1.87	0.050
2.11	0.061
2.43	0.069*
2.75	0.070*
3.16	0.078
3.50	0.092
3.82	0.111
4.15	0.149
4.53	0.186
4.83	0.222
5.14	0.267
5.56	0.337
6.01	0.409
6.42	0.483
7.23	0.642
8.15	0.808
9.64	0.941

CURVE 50

T	k
1.54	0.171
1.89	0.215
2.13	0.243
2.45	0.275
2.75	0.303
3.12	0.339
3.55	0.388
3.84	0.412
4.14	0.446
4.47	0.491
5.15	0.556
5.57	0.605

CURVE 50 (cont.)

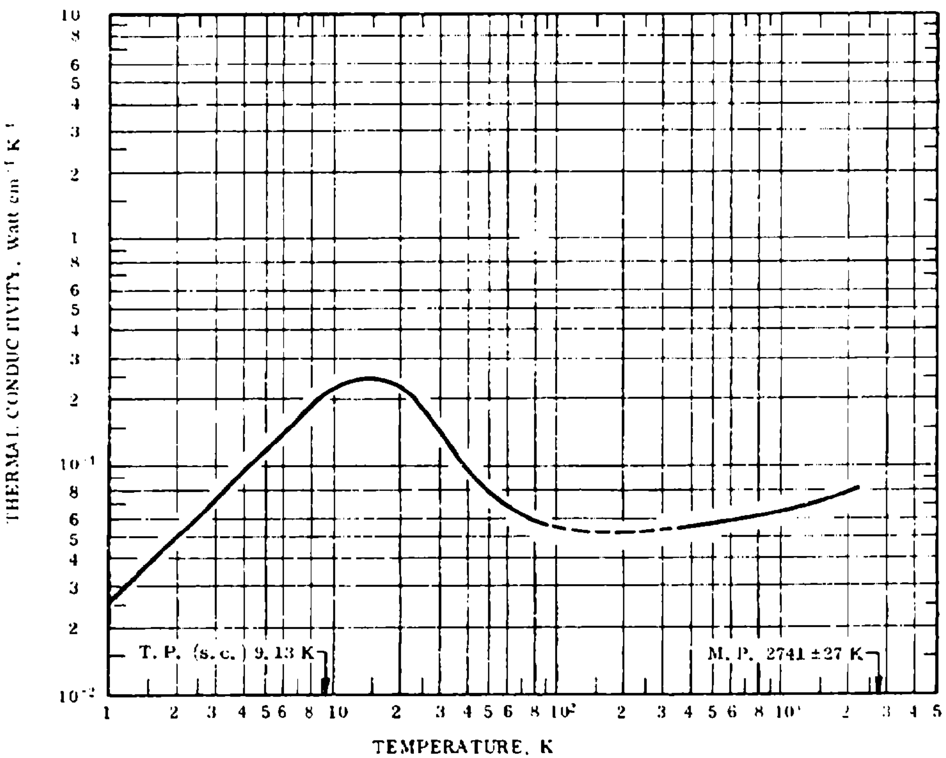
T	k
5.95	0.648
6.49	0.702
7.27	0.782
8.46	0.880
9.87	0.962

CURVE 51

T	k
1400	0.628
1600	0.654
1800	0.680
2000	0.706
2200	0.732
2300	0.745

*Not shown on plot

FIGURE AND TABLE NO. 36R RECOMMENDED THERMAL CONDUCTIVITY OF NIOBIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	0.251	14.5	-457.9
2	0.501	28.9	-456.1
3	0.749	43.3	-454.3
4	0.993	57.4	-452.5
5	1.23	71.1	-450.7
6	1.46	84.4	-448.9
7	1.67	96.5	-447.1
8	1.86	107	-445.3
9	2.04	118	-443.5
10	2.18	126	-441.7
11	2.30	133	-439.9
12	2.39	138	-438.1
13	2.46	142	-436.3
14	2.49	144	-434.5
15	2.50	144	-432.7
16	2.49	144	-430.9
18	2.42	140	-427.3
20	2.29	132	-423.7
25	1.87	108	-414.7
30	1.45	83.8	-405.7
35	1.16	67.0	-396.7
40	0.97	56.0	-387.7
45	0.84	48.5	-378.7
50	0.76	43.9	-369.7
60	0.66	38.1	-351.7
70	0.61	35.2	-333.7
80	0.58	33.5	-315.7
90	0.563	32.5	-297.7
100	(0.552)‡	(31.9)	-279.7
150	(0.530)	(30.6)	-189.7
200	(0.526)	(30.4)	-99.7
250	(0.530)	(30.6)	-9.7
273.2	(0.533)	(30.8)	32.0
300	(0.537)	(31.0)	80.3
350	0.544	31.4	170.3
400	0.552	31.9	260.3

T_1	k_1	k_2	T_2
500	0.567	32.8	440.3
600	0.582	33.6	620.3
700	0.598	34.6	800.3
800	0.613	35.4	980.3
900	0.629	36.3	1160
1000	0.644	37.2	1340
1100	0.659	38.1	1520
1200	0.675	39.0	1700
1300	0.690	39.9	1880
1400	0.705	40.7	2060
1500	0.721	41.7	2240
1600	0.735	42.5	2420
1700	0.750	43.3	2600
1800	0.764	44.1	2780
1900	0.778	45.0	2960
2000	0.791	45.7	3140
2200	0.815	47.1	3500

REMARKS

The recommended values are for well-annealed 99.9⁺% pure niobium with residual electrical resistivity ρ_0 = 0.0975 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 150 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, α' = 5.92 x 10^{-4}, and β = 3.99. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature, and 5 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are interpolated.

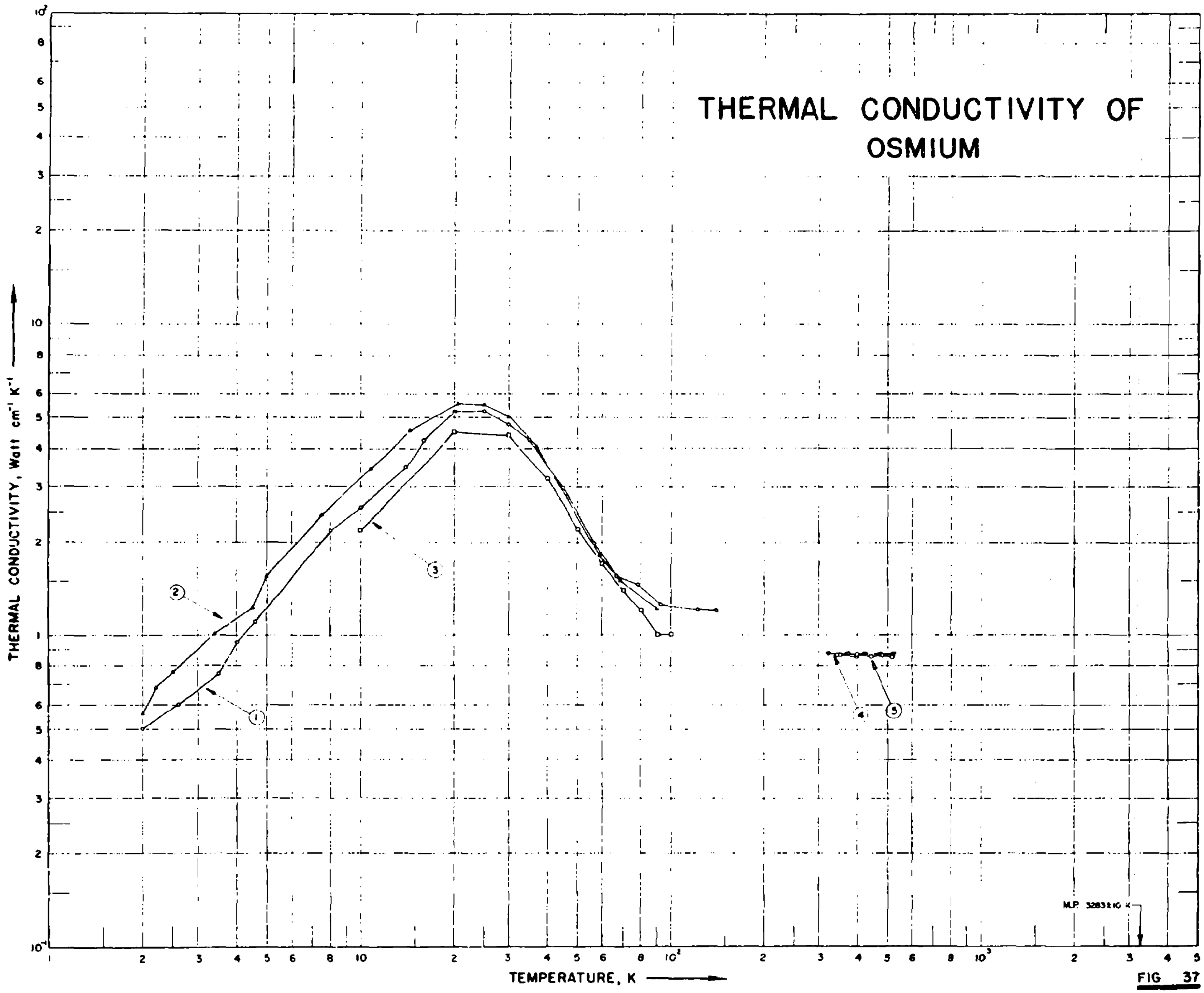

THERMAL CONDUCTIVITY OF OSMIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
4
5
MLP 3283&10 K

FIG 37

SPECIFICATION TABLE NO. 37 THERMAL CONDUCTIVITY OF OSMIUM

(Impurity < 0.20% each; total impurities 0.50%)

[For Data Reported in Figure and Table No. 37]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	384	L	1958	2.0-140		Os 2	99.995 pure; specimen 0.6 cm in dia and 6 cm long; powder supplied by Johnson Matthey and Mallory Ltd.; specimen prepared by arc-melting of pressed powder; residual electrical resistivity 0.10 μohm cm, electrical resistivity ratio $\rho(295K)/\rho_0 = 92.6$.
2	384	L	1958	2.0-91		Os 3	99.99 pure; specimen 0.188 cm in dia and 5 cm long; powder supplied by Baker Platinum Co.; specimen prepared by arc-melting of pressed powder; residual electrical resistivity 0.0872 μohm cm; electrical resistivity ratio $\rho(295K)/\rho_0 = 105.7$.
3	512	L	1957	10-100		Os 1	99.995 pure; powder supplied by Johnson Matthey Co.; specimen prepared by arc-melting of pressed powder in helium atmosphere; electrical resistivity ratio $\rho(295K)/\rho(4.2K) = 20.41$.
4	665	C	1962	323-523			0.0001 Ag, 0.0002 Cu, 0.0005 Fe, 0.002 Rh, and 0.03 Ru; specimen 0.489 cm in dia and 2.7 cm long; supplied by Johnson Matthey Co.; prepared by argon-arc melting and ground to size; density 22.45 g cm^{-3}; electrical resistivity 8.532 and 0.272 μohm cm at 273 and 4.2 K, respectively; electrical resistivity ratio $\rho(273K)/\rho(4.2K) = 31.4$; data extracted from smooth curve.
5	249	C	1967	337-518			0.0001 Ag, 0.0002 Cu, 0.0005 Fe, 0.002 Rh, 0.03 Ru; polycrystalline; specimen 0.489 cm in dia and 2.7 cm long supplied by Johnson Matthey Co.; arc-melted and ground; annealed at 1820 K; density 22.45 g cm^{-3}, electrical resistivity ratio $\rho(273K)/\rho(4.2K) = 33.3$ (the paper reported density as 12.45 g cm^{-3}, and the latter ratio as 22.45, apparently a typographical error. This has been confirmed by the author).

DATA TABLE NO. 37 THERMAL CONDUCTIVITY OF OSMIUM

(Impurity < 0.20% each; total impurities < 0.50%)

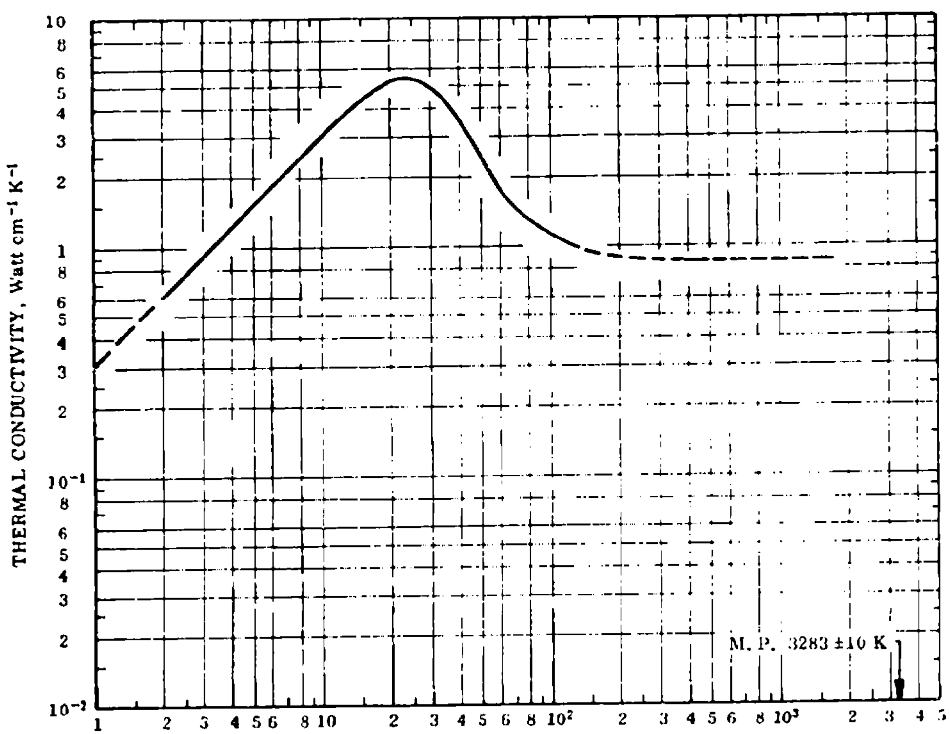
[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
2.0	0.50
2.6	0.60
3.5	0.75
4.0	0.95
4.6	1.10
8.0	2.18
10.0	2.58
14.0	3.50
16.0	4.23
20.0	5.23
25.0	5.25
30.0	4.74
35.0	4.24
45.0	2.98
56.5	1.98
67.0	1.55
78.5	1.46
92.5	1.25
122.0	1.21
140.0	1.20
CURVE 2	
2.0	0.56
2.2	0.68
2.5	0.76
3.4	1.01
4.5	1.22
5.0	1.55
7.5	2.45
10.8	3.46
15.5	4.55
20.6	5.54
25.0	5.50
30.0	5.00
37.0	4.01
59.0	1.80
69.0	1.50
90.8	1.21

T	k
CURVE 3	
10	2.2
20	4.5
30	4.4
40	3.2
50	2.2
60	1.7
70	1.4
80	1.2
90	1
100	1
CURVE 4	
323	0.87
373	0.87
423	0.87
473	0.87
523	0.87
CURVE 5	
336.7	0.866*
343.0	0.862
343.1	0.866*
353.5	0.870
398.4	0.858
399.0	0.870
444.5	0.859
483.1	0.866
517.5	0.854

*Not shown on plot

FIGURE AND TABLE NO. 37R RECOMMENDED THERMAL CONDUCTIVITY OF OSMIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.304)‡	(17.6)	-457.9
2	0.608	35.1	-456.1
3	0.912	52.7	-454.3
4	1.22	70.5	-452.5
5	1.52	87.8	-450.7
6	1.82	105	-448.9
7	2.12	122	-447.1
8	2.42	140	-445.3
9	2.72	157	-443.5
10	3.01	174	-441.7
11	3.29	190	-439.9
12	3.57	206	-438.1
13	3.84	222	-436.3
14	4.09	236	-434.5
15	4.34	251	-432.7
16	4.56	263	-430.9
18	4.94	285	-427.3
20	5.23	302	-423.7
25	5.44	314	-414.7
30	5.00	289	-405.7
35	4.30	248	-396.7
40	3.58	207	-387.7
45	2.95	170	-378.7
50	2.45	142	-369.7
60	1.79	103	-351.7
70	1.50	86.7	-333.7
80	1.33	76.8	-315.7
90	1.21	69.9	-297.7
100	1.13	65.3	-279.7
150	(0.962)	(55.6)	-189.7
200	(0.908)	(52.5)	- 99.7
250	(0.886)	(51.2)	- 9.7
273.2	(0.880)	(50.8)	32.0
300	(0.876)	(50.6)	80.3
350	0.870	50.3	170.3
400	0.869	50.2	260.3
500	0.869	50.2	440.3
600	(0.869)	(50.2)	620.3
1000	(0.869)	(50.2)	1340
1673	(0.869)	(50.2)	2552

REMARKS

The recommended values are for well-annealed 99.99⁺% pure osmium with residual electrical resistivity ρ_0 = 0.0804 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperature below about 250 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 3.00, α' = 3.35 x 10^{-4}, and β = 3.29. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values at room and moderate temperatures and 5 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}. ‡Values in parentheses are extrapolated or interpolated.

THERMAL CONDUCTIVITY OF PALLADIUM

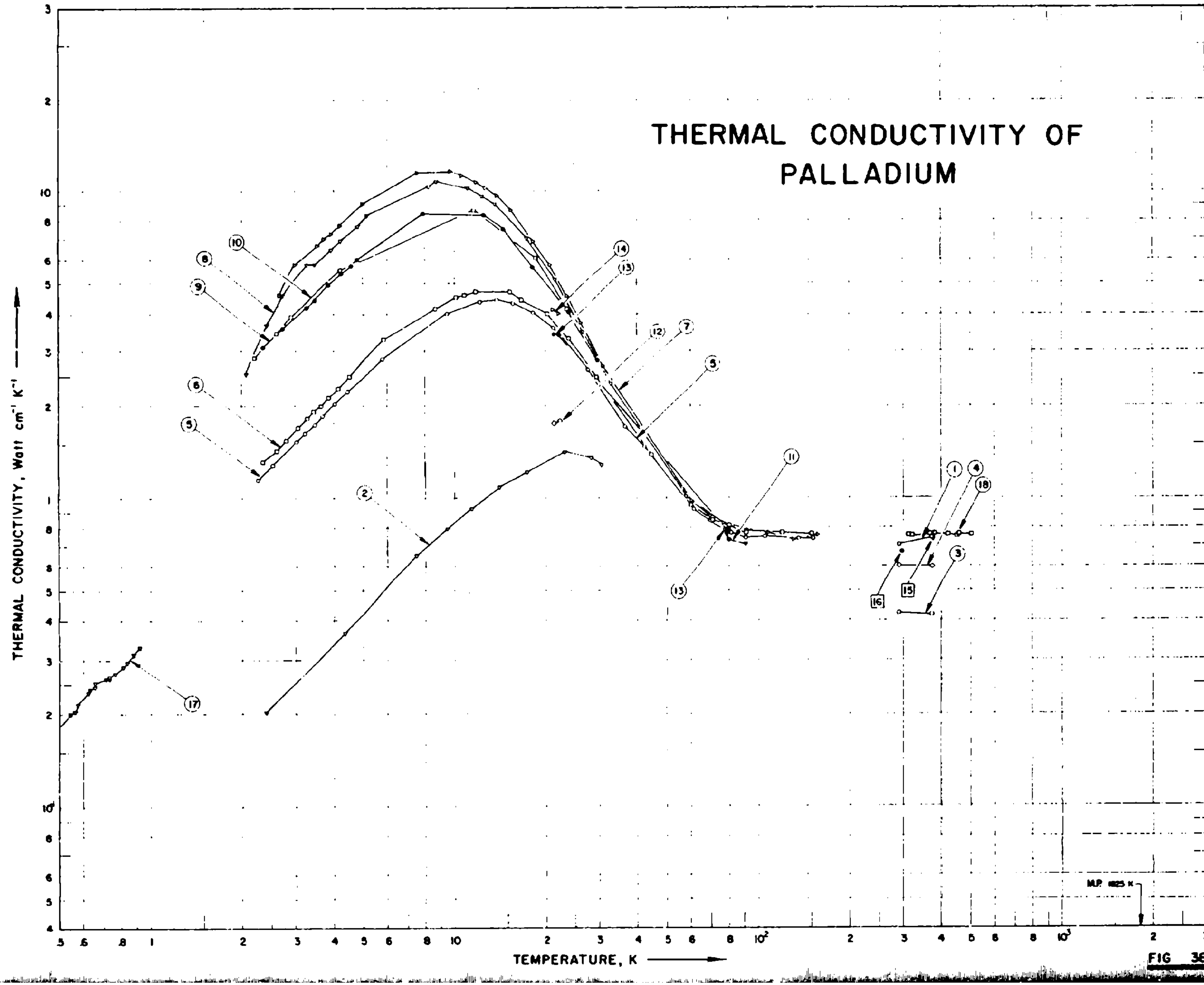


FIG 38

SPECIFICATION TABLE NO. 38 THERMAL CONDUCTIVITY OF PALLADIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 38]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	77	E	1900	291, 373			Pure; specimen 1.610 cm in dia and 27.0 cm long; cast; density 11.96 g cm^{-3} at 18 C.
2	97, 122	L	1952	2.4-31	2.0-3.0	Pd 1	99.995 pure; annealed polycrystal; specimen 0.152 cm in dia and 2.82 cm long; supplied by Johnson Matthey (No. 2134); electrical resistivity ratio $\rho(293K)/\rho(20K)$ = 34.1.
3	8	F	1914	290, 373			Commercially pure; specimen 0.1010 cm in dia and 35.1 cm long; supplied by Messr. Isenthal and Co.; electrical resistivity 17.815 and 18.532 μohm cm at 4.96 and 93.57 C, respectively.
4	8	L	1914	290, 373			Pure; specimen 0.0905 cm in dia and 35.2 cm long; electrical resistivity 10.334 and 13.497 μohm cm at 13.26 and 99.14 C, respectively.
5	82	L	1955	2.3-154		Pd 1	99.995 pure; traces of Ag, Ca, Cu, Si, and Mg; specimen 3 mm in dia; supplied by Johnson Matthey (JM2928); strained.
6	82	L	1955	2.3-150		Pd 2	The above specimen annealed in vacuo for about 4 hrs at 250 C.
7	82	L	1955	2.7-157		Pd 3	The above specimen annealed at 450 C for about 4 hrs.
8	82	L	1955	2.1-131		Pd 4	The above specimen annealed at 650 C for about 4 hrs.
9	82	L	1955	2.4-91		Pd 5	The above specimen annealed at 1000 C for about 4 hrs.
10	82	L	1955	2.2-24		Pd 6	The above specimen drawn to 2 mm dia, annealed at 450 C for about 4 hrs; electrical resistivity $1.82 \times 10^{-6} + 2.12 \times T^{3.2}$ ohm cm (the last term should have a factor 10^{-12}).
11	58	L	1934	79-91		Pd I	Medium pure; unannealed; residual electrical resistivity $\rho(oc)$ = 9.98 μohm cm.
12	58	L	1934	21, 22		Pd I	The above specimen measured after 5.5 months; residual electrical resistivity $\rho(oc)$ = 9.93 μohm cm.
13	58	L	1934	21-91		Pd II	Very pure; drawn and unannealed; residual electrical resistivity $\rho(oc)$ = 9.81 μohm cm.
14	58	L	1934	21-81		Pd II	The above specimen annealed for 2 hrs at 360 C; residual electrical resistivity $\rho(oc)$ = 9.77 μohm cm.
15	390	P	1956	375.2			Pure.
16	241	E	1911	298.2			Pure.
17	736	L	1965	0.42-0.92			Pure palladium.
18	665, 249	C	1962	314-502			0.005 Rh, 0.0005 Au, 0.0005 Fe, 0.0002 Pt, 0.0001 Cu, and < 0.0001 Ag; polycrystalline; specimen 0.636 cm in dia and 6.1 cm long supplied by Johnson Matthey Co.; density 12.02 g cm^{-3}; electrical resistivity 2.72, 7.05, 10.9, 14.5, and 17.9 μohm cm at 100, 200, 300, 400, and 500 K, respectively; $\rho(273K)/\rho(4.2K)$ = 69; Armco iron used as comparative material.

DATA TABLE NO. 38 THERMAL CONDUCTIVITY OF PALLADIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
291.2	0.704
373.2	0.743

CURVE 2

T	k
2.43	0.203
4.35	0.364
7.48	0.653
9.45	0.795
11.48	0.924
14.03	1.082
17.39	1.212
23.13	1.416
28.26	1.356
30.61	1.280

CURVE 3

T	k
290	0.423
373	0.418

CURVE 4

T	k
290	0.602
373	0.598

CURVE 5

T	k
2.261	1.150
2.538	1.288
3.040	1.536
3.230	1.626
3.475	1.744
3.684	1.861
4.046	2.029
4.45	2.232
5.81	2.83
9.45	4.02
12.07	4.39
13.89	4.43
15.60	4.34

CURVE 5 (cont.)

T	k
18.24	4.055
21.31	3.60
27.66	2.62
36.64	1.71
42.59	1.475
61.71	0.917
69.9	0.844
81.8	0.769
91.3	0.741
106.1	0.748
136.8	0.736
153.6	0.739

CURVE 6

T	k
2.347	1.315
2.600	1.432
2.792	1.549
3.053	1.694
3.277	1.814
3.421	1.903
3.622	1.998
3.847	2.124
4.131	2.273
4.501	2.491
5.84	3.28
8.61	4.18
10.06	4.51
10.80	4.60
11.72	4.71
15.32	4.70
16.63	4.42
20.25	4.00
23.87	3.30
29.39	2.48
44.54	1.37
60.1	0.946
70.8	0.843
80.3	0.813
91.1	0.767
91.1	0.780

CURVE 6 (cont.)

T	k
120.2	0.768
150.1	0.764

CURVE 7

T	k
2.654	4.591
2.987	5.76
3.543	6.696
3.738	7.000
3.913	7.283
4.184	7.717
4.998	9.009
7.53	11.50
9.67	11.60
10.53	11.36
11.84	10.74
12.69	10.32
13.83	9.67
15.42	8.67
18.11	6.98
20.55	5.77
23.48	4.56
26.06	3.75
30.83	2.68
60.13	0.978
76.66	0.822
91.0	0.765*
108.9	0.767
131.8	0.733
157.0	0.756

CURVE 8

T	k
2.059	2.512
2.418	3.67
2.703	4.59
3.276	5.77
3.460	5.78
3.925	6.49
4.21	6.91
4.80	7.69

CURVE 8 (cont.)

T	k
5.14	8.30
8.20	10.43
8.74	10.76
11.07	10.20
12.33	9.65
13.52	9.06
17.33	7.02
21.52	5.12
26.62	3.49
32.79	2.36
57.93	1.003
61.0	0.959*
69.9	0.872
80.2	0.808*
90.9	0.771*
130.7	0.735*

CURVE 9

T	k
2.35	3.08
2.72	3.58
3.26	4.20
3.47	4.43
3.86	4.93
4.21	5.36
4.58	5.72
4.77	6.00
7.90	8.39
12.59	8.32
14.60	7.51
19.15	5.66
23.95	4.06
29.60	2.79
60.29	0.952*
70.25	0.861*
81.33	0.789*
91.04	0.774*

CURVE 10

T	k
2.2	2.85
2.6	3.45
2.9	3.93
4.2	5.52
11.6	8.61
14.5	7.60*
18.5	6.07
23.5	4.15

CURVE 11

T	k
79.4	0.762
80.4	0.732
91.2	0.709

CURVE 12

T	k
21.3	1.75
22.3	1.77

CURVE 13

T	k
21.4	3.43
21.4	3.44*
22.2	3.40
78.7	0.786
80.2	0.785
91.4	0.735*

CURVE 14

T	k
21.2	4.14
22.1	4.02
80.7	0.782*

CURVE 15

T	k
375.2	0.745*

CURVE 16

T	k
298.2	0.670

CURVE 17

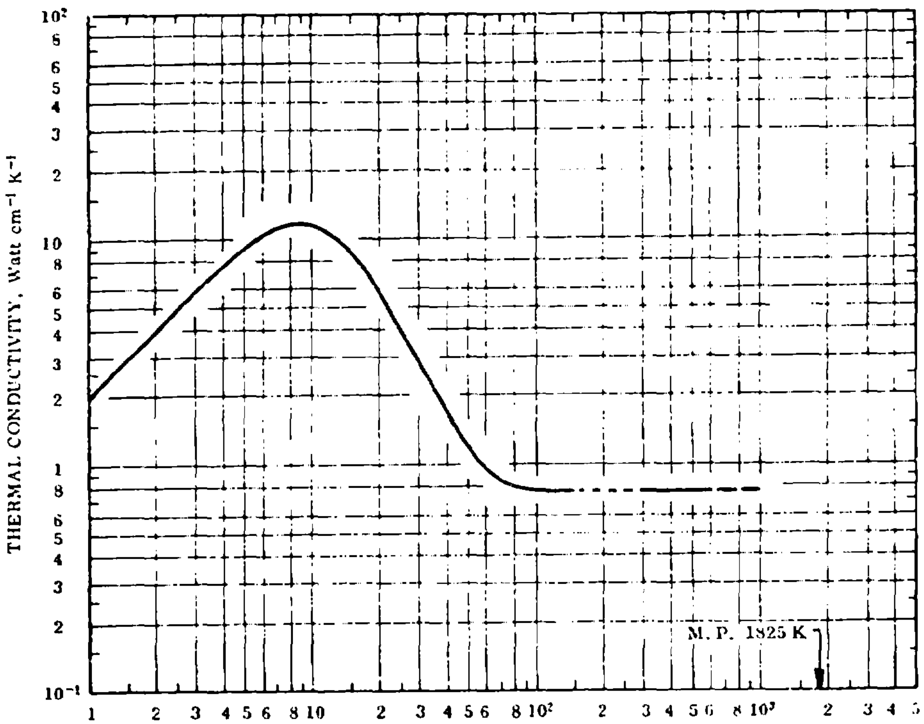
T	k
0.418	0.153
0.45	0.161
0.47	0.168
0.545	0.200
0.568	0.204
0.578	0.215
0.625	0.234
0.635	0.240
0.655	0.245
0.655	0.253
0.713	0.250
0.733	0.260
0.735	0.264
0.765	0.270
0.815	0.285
0.838	0.294
0.883	0.313
0.92	0.330

CURVE 18

T	k
313.8	0.754
320.3	0.750
326.2	0.754
345.0	0.750*
343.5	0.745*
347.1	0.749*
366.1	0.761*
381.4	0.761
422.8	0.755
451.5	0.748
452.1	0.752*
456.3	0.760
501.7	0.758

* Not shown on plot

FIGURE AND TABLE NO. 38R RECOMMENDED THERMAL CONDUCTIVITY OF PALLADIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.755	43.6	440.3
1	1.99	115	-457.9	600	(0.755)	(43.6)	620.3
2	3.96	229	-456.1	700	(0.755)	(43.6)	800.3
3	5.86	339	-454.	800	(0.755)	(43.6)	980.3
4	7.61	440	-452.5	900	(0.755)	(43.6)	1160
5	9.13	528	-450.7	1000	(0.755)	(43.6)	1340
6	10.3	595	-448.9				
7	11.1	641	-447.1				
8	11.6	670	-445.3				
9	11.7	676	-443.5				
10	11.5	664	-441.7				
11	11.2	647	-439.9				
12	10.7	618	-438.1				
13	10.1	584	-436.3				
14	9.49	548	-434.5				
15	8.88	513	-432.7				
16	3.28	478	-430.9				
18	7.08	409	-427.3				
20	5.98	346	-423.7				
25	4.04	233	-414.7				
30	2.85	165	-405.7				
35	2.15	124	-396.7				
40	1.72	99.4	-387.7				
45	1.43	82.6	-378.7				
50	1.23	71.1	-369.7				
60	0.982	56.7	-351.7				
70	0.868	50.2	-333.7				
80	0.811	46.9	-315.7				
90	0.786	45.4	-297.7				
100	0.773	44.7	-279.7				
150	0.755	43.6	-189.7				
200	(0.755)‡	(43.6)	- 99.7				
250	(0.755)	(43.6)	- 9.7				
273.2	(0.755)	(43.6)	32.0				
300	0.755	43.6	80.3				
350	0.755	43.6	170.3				
400	0.755	43.6	260.3				

REMARKS

The recommended values are for well-annealed 99.995% pure palladium with residual electrical resistivity ρ_0 = 0.0123 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 150 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, a = 0.40, m = 2.40, α'' = 1.54 x 10^{-4}, and β = 0.502. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}. ‡Values in parentheses are extrapolated or interpolated.

FIGURE SHOWS ONLY 29 OF THE CURVES REPORTED IN TABLE

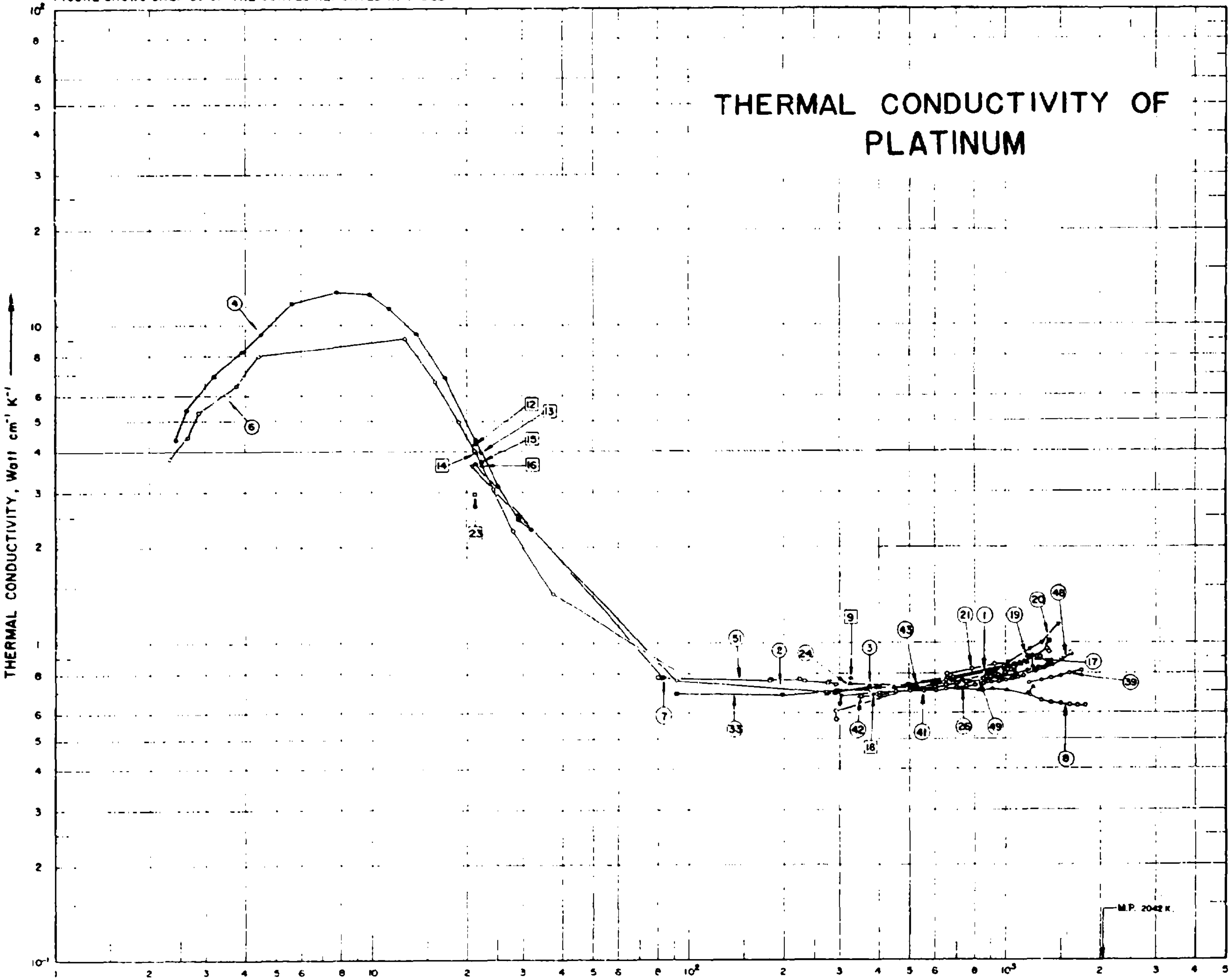


FIG. 39

SPECIFICATION TABLE NO. 39 THERMAL CONDUCTIVITY OF PLATINUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 39]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	70	E	1930	293-1293	3		99.95 pure; electrical resistivity data fitted into the equation $\rho = 10.48[1 + 3.695 \times 10^{-3} \times (T-15) - 5.98 \times 10^{-7} \times (T-15)^2 + 5.25 \times 10^{-11} \times (T-15)^3]$ μohm cm, T in C.
2	95	E	1915	21-374			Very high purity; drawn and electrically annealed; electrical conductivity 10.2 and 9.5 x 10^4 mho cm^{-1} at 278.1 and 291 K, respectively.
3	77	E	1900	291,373		Pt II	Pure; specimen 1.614 cm in dia and 27.0 cm long; density 21.39 g cm^{-3} at 18 C.
4	97, 122	L	1952	2.4-32	2-3	Pt I	99.999 pure; supplied by Johnson Matthey and Co. (JM 2157b); annealed wire; $\rho(293 K)/\rho(20 K) = 202$.
5	8	F	1914	273-373			Pure; electrical conductivity 10.24 and 7.35 x 10^4 mho cm^{-1} at 273 and 373 K, respectively.
6	143	L	1957	2.3-91			99.99+ pure; specimen 1.5 mm in dia; supplied by Baker Platinum Co.; annealed at 1050 C; $\rho(295 K)/\rho_0 = 833$; residual electrical resistivity 0.0125 μohm cm.
7	57	L	1927	21, 83		Pt III	Very pure; polycrystal; drawn and electrically annealed; electrical resistivity 0.0650, 2.10, and 9.81 μohm cm at -252, -190 and 0 C, respectively.
8	273	E	1954	1200-1800			Spectroscopically pure wire; obtained from Johnson Matthey and Co.
9	487	L	1894	326.2			Pure; specimen 2.0 mm in dia.
10	451	C	1930	291.2			Pure; tempered at 800 C and quenched, rolled and drawn; gold used as comparative material [k data 3.09 W $cm^{-1}K^{-1}$].
11	399	L	1925	290,373			Pure.
12	436	L	1938	21.17		Pt IV 33	Quasi-isotropic; electrical resistivity 0.0416 and 9.81 μohm cm at 21.38 and 273.2 K, respectively.
13	436	L	1938	22.01		Pt IV 33	The above specimen, second measurement.
14	436	L	1938	21.21		Pt IV 33	The above specimen measured at H = 8750 oersteds; electrical resistivity 0.04578 μohm cm at 21.38 K.
15	436	L	1938	22.10		Pt IV 33	The above specimen measured at H = 8750 oersteds.
16	436	L	1938	22.15		Pt IV 33	The above specimen measured at H = 12200 oersteds; electrical resistivity 0.04820 μohm cm at 21.38 K.
17	488	E	1929	293-1293	0.7-2.0		99.95 pure; electrical resistivity 10.65, 24.90, 35.01 and 43.61 μohm cm at 20, 412, 725, and 1020 C, respectively.
18	390	P	1956	384.2			Pure.
19	503	E	1961	1073-1223			99.9 chemically pure; specimen in the form of 0.1 mm dia wire stretched between two heaters; wire surface polished with Viennese chalk or Paris red (crocus, polishing powder); annealed at about 1000 C for 12 hrs.
20	599	E	1961	301-1473			99.9 pure; electrical resistivity 10.6 μohm cm at 23 C.
21	599	E	1961	292-1376			Similar to the above specimen.
22	241	L	1911	298.2			Less than 0.03 impurity.

SPECIFICATION TABLE NO. 39 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
23	57	L	1927	21.2		Pt IV	Pure; polycrystal; annealed; electrical resistivity 0.0899 and 9.83 μohm cm at 21.2 and 273.2 K, respectively.
24	665	C	1962	323, 523			0.0001 Cu, 0.0001 Fe, and < 0.0001 Pd; specimen 0.635 cm in dia and 6.1 cm long; supplied by Johnson Matthey and Co.; annealed at approx 1000 C; density 21.51 g cm^{-3}; electrical resistivity 0.013 and 9.85 μohm cm at 4.2 and 273 K, respectively; 0.321 cm dia Armco iron rod used as comparative material; heat outflow also measured by water-flow calorimeter.
25	645	C	1963	315-503		Pt 1	0.0001 Cu, 0.0001 Fe, and < 0.0001 Pd; specimen 0.62 cm in dia and 6.1 cm in length; density 21.5 g cm^{-3}; machined; annealed at about 1000 C; 0.321 cm dia Armco iron rod used as comparative material; heat outflow also measured by water-flow calorimeter.
26	645	C	1963	445-1220		Pt 1	The above specimen; 0.371 cm dia Armco iron rod used as comparative material.
27	645	C	1963	787-1153		Pt 1	The above specimen; 1.273 cm dia Armco iron rod used as comparative material.
28	645	C	1963	760-1070		Pt 1	Same as above; reassembled.
29	645	C	1963	335-467		Pt 2	0.0001 Si, < 0.0001 Ag, < 0.0001 Ca, < 0.0001 Cu, 0.0001 Fe, < 0.0001 Mg, and < 0.0001 Pd; specimen 1.269 cm in dia and 10.16 cm in length; annealed at ~1000 C; density 21.5 g cm^{-3}; electrical resistivity (measured after all other tests) 9.9, 13.8, 17.4, 21.0, 24.5, 27.9, 31.1, 34.3, 37.3, 40.2, and 43.0 μohm cm at 0, 100, 200, 300, 400, 500, 600, 700, 800, 900, and 1000 C, respectively; Lorenz function at these temperatures being respectively 2.66, 2.70, 2.68, 2.67, 2.65, 2.64, 2.60, 2.57, 2.54, 2.51, and 2.47 x 10^{-8} V^{2}K^{-2}; 1.222 cm dia Armco iron rod used as comparative material; heat outflow also measured by water-flow calorimeter.
30	645	C	1963	357-800		Pt 2	Same as above but 1.9 cm dia Armco iron rod used as comparative material.
31	645	C	1963	575-1141		Pt 2	The above specimen; 0.371 cm dia Armco iron rod used as comparative material.
32	736	L	1965	0.43-0.82		Pt 2	Pure platinum wire.
33	847	E	1952	90-579			Wire 11.6 cm long and 1.5 mm dia.
34	662	L	1964	298-358	0.5		99.98 pure; ≈0.0030 Ir, 0.0021-0.0023 Ca, 0.0021-0.0023 Rh, 0.0015-0.0017 Al, 0.0015-0.0017 Pd, 0.0011 Au, 0.0007-0.0009 Mg, 0.0007-0.0009 Ag, and 0.0004-0.0005 Fe; specimen 5.0 cm in dia and 7.0 cm long; cast, cold-pressed and machined; density 21.32 g cm^{-3} at 20 C; held at 600 C for 2 hrs; first run. 0.004-0.006 Cu
35	662	L	1964	294-349	0.5		The above specimen; second run.
36	662	L	1964	294, 365	0.5		The above specimen; third run.
37	662	L	1964	296-363	0.5		The above specimen; fourth run.
38	‡	L	1967	0.42-0.81	<1.0		99.999 pure; polycrystalline wire specimen; form factor l/a = 7.74 x 10^3 cm^{-1}; obtained from Johnson and Matthey Co.; electrical resistivity 0.08004 μohm cm at 1.5 K; ρ(293 K)/ρ(1.5 K) = 148.

‡Sharma, J.K.N., Cryogenics, 1(3), 141-56, 1967.

SPECIFICATION TABLE NO. 39 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
39	654	P	1963	1180-1750			99.95 Pt sheet of 1 mm thickness; average grain size after test 1000 μ; density 21.5 g cm^{-3}; data calculated from thermal diffusivity measurements using the specific heat data of Kubaschewski, O. and Evans, L. Ll. (Metallurgical Thermochemistry, Pergamon Press, 1956).
40	624	E	1959	323-773			99.99 pure; polycrystal.
41	648, 993	P	1964	300-1150	±3	I	99.999 Pt, impurities (atomic %): 0.002 Pd, 0.001 Ir, 0.001 Ag, 0.001 Zn, 0.0006 Mo, 0.0006 Os, 0.0006 Ru, 0.0004 In, 0.0002 Re, 0.0002 W, 0.0001 Cu, 0.00007 Rh, and 0.00006 Ta; supplied by J. Bishop and Co.; $\rho_{273 K}/\rho_{4 K}$ = 900, annealed at 1200 K for at least 1 hr; data calculated from thermal diffusivity data using a constant density of 21.37 g cm^{-3} and the specific heat data of Jaeger, F.M. and Rosenbohm, E. (Physica, 6, 1123-5, 1939).
42	648, 993	P	1964	300-1250	±3	II	99.9 Pt, impurities (atomic %): 0.35 Rh, 0.24 Ir, 0.05 Pd, 0.04 Ag, 0.034 Ru, 0.015 Cu, 0.006 Zn, 0.001 W, 0.0006 Ta, 0.0005 In, 0.0004 Re, 0.0001 Os, and < 0.0001 Mo; supplied by J. Bishop and Co.; ρ_{273K}/ρ_{4K} = 12; annealed at 1200 K for at least one hr; data calculated from thermal diffusivity data using a constant density of 21.37 g cm^{-3} and the specific heat data of Jaeger, F.M. and Rosenbohm, E. (Physica, 6, 1123-5, 1939).
43	689, 690	E	1965	273-1383	< 5		Platinum wire 0.3 mm in dia.
44	700, 993	P	1965	400-1200	±3	B	99.999 Pt (nominal), impurities (atomic %): 0.2 Pd, 0.06 Cu, 0.057 Rh, 0.01 Ag, 0.004 Zn, 0.001 Ir, 0.001 Ru, 0.0006 Os, 0.0002 Re, 0.0002 W, < 0.0001 Mo, 0.00007 Ta, and 0.00006 In; rod 0.1875 in. in dia and about 10 in. long; supplied by Engelhard Industries; annealed at 1200 K for at least one hr; electrical resistivity, 10.95, 14.75, 18.45, 22.10, 25.64, 29.00, 32.20, 35.35, and 38.45 μohm cm at 300, 400, 500, 600, 700, 800, 900, 1000, and 1100 K respectively and electrical resistivity ratio $\rho_{273K}/\rho_{4.2K}$ = 100 determined upon completion of the thermal diffusivity measurements; thermal conductivity values calculated from the thermal diffusivity measurements using a constant density of 21.37 g cm^{-3} from Smithsonian Physical Tables (1954) and also specific heat data of Jaeger and Rosenbohm (1939).
45	700, 993	P	1965	400-1200	±3	C	Data from a similar specimen having a nominal purity of 99.9; impurities (atomic %): 0.009 Rh, 0.006 Pd, 0.004 Ag, 0.003 Zn, 0.002 Cu, 0.001 Ir, 0.0006 W, 0.0005 In, 0.0004 Re, 0.0003 Os, < 0.0003 Mo, 0.0002 Ta, and < 0.0002 Ru; and electrical resistivity 11.30, 15.13, 18.90, 22.60, 26.14, 29.51, 32.76, 35.86, and 38.89 μohm cm at 300, 400, 500, 600, 700, 800, 900, 1000, and 1100 K respectively; $\rho_{273K}/\rho_{4.2K}$ = 34.

SPECIFICATION TABLE NO. 39 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
46	700, 993	P	1965	400-1200	±3	D	Data from another specimen having a nominal purity of 99.999; impurities (atomic %): 0.002 Zn, 0.001 Cu, 0.001 In, 0.001 Ir, 0.001 Pd, 0.001 Ag, 0.0006 Mo, 0.0006 Os, 0.0006 Ru, 0.0002 Re, 0.0002 W, 0.00007 Rh, and 0.00006 Ta; from Sigmund Cohn Corp. with a corresponding electrical resistivity of 10.90, 14.68, 18.40, 21.98, 25.45, 28.82, 32.04, 35.10, and 38.13 μohm cm at 300, 400, 500, 600, 700, 800, 900, 1000, and 1100 K, respectively; $\rho_{273K}/\rho_{4.2K}$ ~5000.
47	507	L	1966	300-1000	±1.7		99.999 Pt, 0.0004 Rh, 0.0003 Fe; specimen 1.2 cm in dia and 10 cm long; supplied by Engelhard Industries, Inc., Newark, New Jersey; machined from a special lot of platinum.
48	878	P	1966	970-1611			Nominal purity 99.9, following percentages are upper limits: 0.1 Ag, 0.2 Au, 0.01 Cr, 0.1 Cu, 0.1 Fe, 0.01 Mn, 0.01 Ni, 0.1 Pd, 0.2 Rh, 0.2 Ru, 0.1 Si; specimen 0.479 cm in dia and 15 cm long; supplied by Engelhard Inc.; electrical resistivities from smoothed curve of author's measurements: 34.54, 35.68, 37.90, 40.06, 42.60, 45.01, 46.89, 49.75, and 52.28 μohm cm at 970, 1006, 1078, 1153, 1243, 1331, 1402, 1511, and 1611 K respectively; thermal conductivity values calculated from the thermal diffusivity measurements using a constant density 21.37 g cm^{-3} from Forsythe, W.E. (Smithsonian Physical Tables, 9th revised ed.) and the specific heat data of Jaeger, F.M. and Rosenbohm, E. (Physica 6, 1123, 1939).
49	879, 991, 1000	L	1966	373-1373			99.987 pure; density 21.384 ± 0.002 g cm^{-3} at 21 C, ice point resistivity 9.847 ± 0.01 μohm cm (corrected to 0 C dimensions); Vickers Hardness Number subsequent to annealing 37.
50	879, 991	E	1966	373-1373			The above specimen measured by different method.
51	249	C	1967	80-294		Platinum I	0.0001 Cu, 0.0001 Fe, <0.0001 Pd; polycrystalline specimen 0.635 cm in dia and 6.1 cm long; supplied by Johnson, Matthey and Co., annealed at 1273 K; density 21.51 g cm^{-3}, electrical resistivity ratio $\rho_{273K}/\rho_{4.2K}$ = 740.
52	249	C	1967	300-500		Platinum II	0.0001 each of Fe and Si, < 0.0001 each of Hg, Cu, Pd, Ca, and Mg; polycrystalline; specimen 1.269 cm in dia and 10.16 cm, long; supplied by Johnson, Matthey and Co., annealed at 1250 K; density 21.5 g cm^{-3}.
53	989	E	1947	195-373			Wire specimen 1.438 ± 0.003 mm in dia; measured in a vacuum of $<10^{-5}$ mm Hg.

DATA TABLE NO. 39 THERMAL CONDUCTIVITY OF PLATINUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
292.7	0.699
689.2	0.779
998.2	0.842
1293.2	0.900

CURVE 2

T	k
20.7	3.635
91.4	0.762
273.1	0.699
291.1	0.701
294.2	0.701*
373.8	0.706

CURVE 3

T	k
291.2	0.696
373.2	0.725

CURVE 4

T	k
2.41	4.387
2.60	5.450
3.18	6.968
3.90	8.315
4.47	9.462
5.59	11.785
7.74	12.820
9.81	12.560
11.35	11.400
13.76	9.462
16.95	6.882
21.25	4.387
24.95	3.140
29.00	2.452
31.74	2.280

CURVE 5*

T	k
273.2	0.691
290.2	0.690
373.2	0.711

CURVE 6

T	k
2.30	3.810
2.63	4.459
2.85	5.325
3.75	6.494
4.39	8.052
12.72	9.134
15.79	6.667
18.86	4.978
21.05	4.026
24.12	3.074
27.85	2.251
37.28	1.429
91.00	0.823

CURVE 7

T	k
21.2	3.690
83.2	0.780

CURVE 8

T	k
1200	0.680
1300	0.656
1400	0.647
1500	0.641
1600	0.636
1700	0.634
1800	0.633

CURVE 9

T	k
326.2	0.778

CURVE 10*

T	k
291.2	0.69

CURVE 11*

T	k
290.2	0.690
373.2	0.711

CURVE 12

T	k
21.17	4.25

CURVE 13

T	k
22.01	3.97

CURVE 14

T	k
21.21	3.98

CURVE 15

T	k
22.10	3.74

CURVE 16

T	k
22.15	3.63

CURVE 17

T	k
293.2	0.701
685.2	0.776
998.2	0.836
1293.2	0.897

CURVE 18

T	k
384.2	0.690

CURVE 19

T	k
1073.2	0.82
1118.2	0.87
1128.2	0.86
1148.2	0.88
1173.2	0.87
1173.2	0.91
1223.2	0.91
1223.2	0.84

CURVE 20

T	k
301	0.640
363	0.678
590	0.738
730	0.761
880	0.794
921	0.805
1037	0.875
1200	0.960
1331	1.00
1473	1.14

CURVE 21

T	k
292	0.577
293	0.609
649	0.762
654	0.798
784	0.830
925	0.857
1085	0.860
1240	0.929
1245	0.890
1365	0.962
1376	0.939

CURVE 22*

T	k
298.2	0.700

CURVE 23

T	k
21.2	2.96

CURVE 24

T	k
323.2	0.740
523.2	0.725

CURVE 25*

T	k
315	0.737
323	0.732
325	0.739

CURVE 25* (cont.)

T	k
327	0.730
330	0.725
337	0.732
343	0.724
343	0.738
360	0.722
370	0.735
373	0.736
385	0.723
395	0.732
420	0.727
430	0.727
437	0.715
453	0.722
480	0.712
503	0.723

CURVE 26

T	k
445	0.725
710	0.714
827	0.707
910	0.715
1011	0.707
1170	0.690
1220	0.726

CURVE 27

T	k
787	0.719
833	0.723
977	0.723
1027	0.730
1140	0.739
1153	0.723

CURVE 28

T	k
760	0.707
810	0.736
880	0.718
890	0.718
1030	0.735
1070	0.722

CURVE 29*

T	k
335	0.725
346	0.725
370	0.718
371	0.750
376	0.734
392	0.729
401	0.732
434	0.729
437	0.724
440	0.733
467	0.721

CURVE 30*

T	k
357	0.732
393	0.715
444	0.732
496	0.734
512	0.722
518	0.728
618	0.724
637	0.724
662	0.729
677	0.721
689	0.730
713	0.725
730	0.736
741	0.722
755	0.729
800	0.733

CURVE 31*

T	k
575	0.738
648	0.732
726	0.735
846	0.731
944	0.721
1088	0.734
1109	0.738
1141	0.732

CURVE 32*

T	k
0.425	0.115
0.435	0.125
0.470	0.135
0.480	0.138
0.500	0.148
0.560	0.163
0.575	0.175
0.590	0.178
0.600	0.185
0.638	0.198
0.645	0.207
0.680	0.213
0.710	0.223
0.720	0.223
0.745	0.231
0.770	0.245
0.773	0.248
0.790	0.258
0.815	0.265

CURVE 33

T	k
90.2	0.693
194.7	0.688
273.2	0.702
373.2	0.720
491.2	0.733
579.1	0.743

CURVE 34

T	k
297.7	0.7048
297.9	0.7056
312.9	0.7045
327.8	0.7048
343.0	0.7069
358.1	0.7097

CURVE 35*

T	k
294.3	0.7041
297.7	0.7049
305.2	0.7034
318.7	0.7051

* Not shown on Plot

DATA TABLE NO. 39 (continued)

T	k
CURVE 35 (cont.)*	
333.9	0.7065
349.2	0.7076
CURVE 36*	
294.4	0.7042
364.8	0.7091
CURVE 37*	
296.0	0.7062
319.9	0.7058
339.2	0.7081
363.0	0.7121
CURVE 38*	
0.422	0.115
0.432	0.126
0.465	0.133
0.477	0.138
0.496	0.147
0.567	0.162
0.574	0.172
0.577	0.178
0.598	0.187
0.636	0.199
0.641	0.205
0.676	0.214
0.708	0.223
0.742	0.232
0.770	0.244
0.792	0.257
0.811	0.264
CURVE 39	
1180	0.743
1300	0.759
1400	0.772
1500	0.785
1600	0.798
1750	0.818

T	k
CURVE 40*	
323.2	0.6903
373.2	0.7196
473.2	0.7238
573.2	0.7405
673.2	0.7698
773.2	0.7907
CURVE 41	
300	0.698*
350	0.701*
400	0.702
450	0.707
500	0.708
550	0.712
600	0.716
650	0.719
700	0.725
750	0.732
800	0.738
850	0.744
900	0.751
950	0.758
1000	0.768
1050	0.775
1100	0.784
1150	0.791
CURVE 42	
300	0.763*
350	0.682
400	0.691
450	0.701*
500	0.710
550	0.720
600	0.729
650	0.739
700	0.749
750	0.757
800	0.765*
850	0.775
900	0.787
950	0.799
1000	0.813
1050	0.828

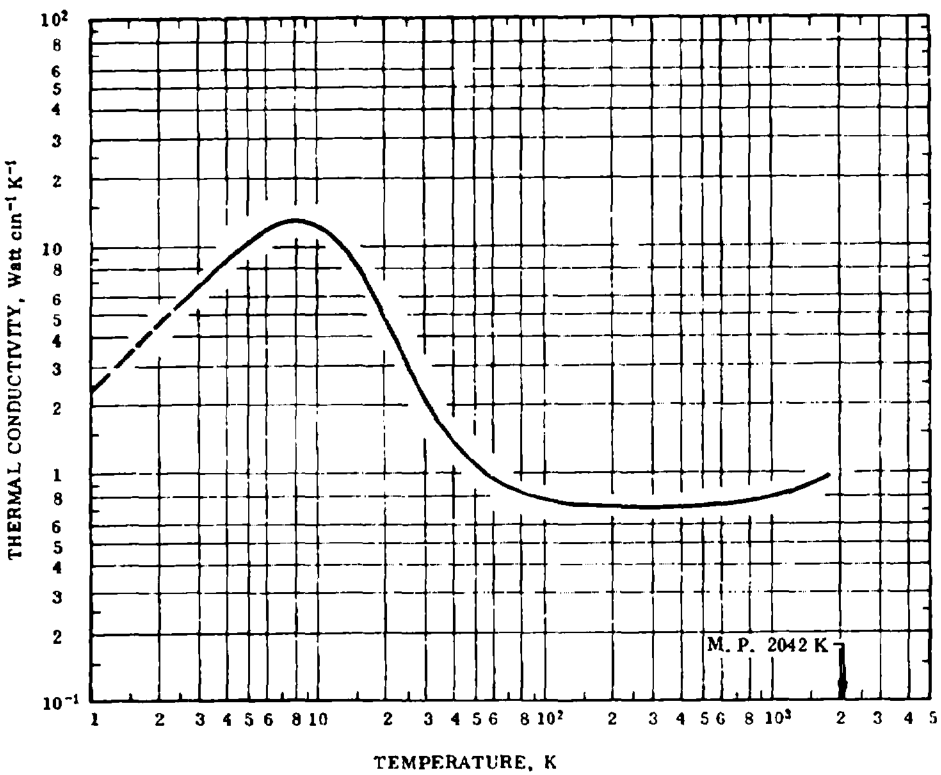
T	k
CURVE 42 (cont.)	
1100	0.846*
1150	0.860*
1200	0.875*
1250	0.884*
CURVE 43	
273.2	0.690
493.2	0.733
673.2	0.770
893.2	0.813
1073.2	0.855
1273.2	0.909
1383.2	1.01
CURVE 44*	
400	0.684
500	0.700
600	0.710
700	0.722
800	0.738
900	0.754
1000	0.774
1100	0.794
1200	0.821
CURVE 45*	
400	0.675
500	0.684
600	0.694
700	0.710
800	0.726
900	0.745
1000	0.765
1100	0.785
1200	0.805
CURVE 46*	
400	0.687
500	0.696
600	0.707
700	0.719
800	0.732

T	k
CURVE 46 (cont.)*	
900	0.751
1000	0.778
1100	0.791
1200	0.815
CURVE 47*	
300	0.710
400	0.712
500	0.715
600	0.721
700	0.729
800	0.740
900	0.756
1000	0.781
CURVE 48	
970	0.758
1006	0.766*
1078	0.779
1153	0.792*
1243	0.811
1331	0.830
1402	0.859
1511	0.883
1611	0.922
CURVE 49	
373.2	0.7147*
473.2	0.7196*
573.2	0.7274*
673.2	0.7378*
773.2	0.7505
873.2	0.7652
973.2	0.7815
1073.2	0.7992
1173.2	0.8180
1273.2	0.8366
1373.2	0.8577
CURVE 50*	
373.2	0.7186
473.2	0.7236

T	k
CURVE 50 (cont.)*	
573.2	0.7315
673.2	0.7417
773.2	0.7538
873.2	0.7670
973.2	0.7816
1073.2	0.7963
1173.2	0.8108
1273.2	0.8248
1373.2	0.8375
CURVE 51	
80.1	0.782
81.1	0.780
179.4	0.760
182.8	0.768
224.2	0.768
233.5	0.758
275.3	0.745
276.2	0.745*
277.0	0.750
293.1	0.740*
293.7	0.735
CURVE 52*	
300	0.73
400	0.735
500	0.735
CURVE 53	
194.7	0.6707
273.2	0.7008
373.2	0.7071

*Not shown on plot

FIGURE AND TABLE NO. 39R RECOMMENDED THERMAL CONDUCTIVITY OF PLATINUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(2.31)‡	(134)	-457.9
2	(4.60)	(266)	-456.1
3	6.79	392	-454.3
4	8.60	509	-452.5
5	10.5	607	-450.7
6	11.8	682	-448.9
7	12.6	728	-447.1
8	12.9	745	-445.3
9	12.8	740	-443.5
10	12.3	711	-411.7
11	11.7	676	-439.9
12	10.9	630	-438.1
13	10.1	584	-436.3
14	9.30	537	-434.5
15	8.41	486	-432.7
16	7.59	439	-430.9
18	6.12	354	-427.3
20	4.95	286	-423.7
25	3.13	181	-414.7
30	2.15	124	-405.7
35	1.68	97.1	-396.7
40	1.39	80.3	-387.7
45	1.22	70.5	-378.7
50	1.09	63.0	-369.7
60	0.947	54.7	-351.7
70	0.862	49.8	-333.7
80	0.815	47.1	-315.7
90	0.789	45.6	-297.7
100	0.775	44.8	-279.7
150	0.740	42.8	-189.7
200	0.724	41.8	- 99.7
250	0.717	41.4	- 9.7
273.2	0.715	41.3	32.0
300	0.714	41.3	80.3

T_1	k_1	k_2	T_2
350	0.715	41.3	170.3
400	0.716	41.4	260.3
500	0.722	41.7	440.3
600	0.730	42.2	620.3
700	0.741	42.8	800.3
800	0.755	43.6	980.3
900	0.770	44.5	1160
1000	0.786	45.4	1340
1100	0.805	46.5	1520
1200	0.826	47.7	1700
1300	0.848	49.0	1880
1400	0.871	50.3	2060
1500	0.896	51.8	2240
1600	0.921	53.2	2420
1700	0.947	54.7	2600
1800	0.973	56.2	2780

REMARKS

The recommended values are for well-annealed 99.999+% pure platinum with residual electrical resistivity $\rho_0 = 0.0106$ $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 150 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.10, $\alpha' = 3.01 \times 10^{-4}$, and $\beta = 0.433$. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

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* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

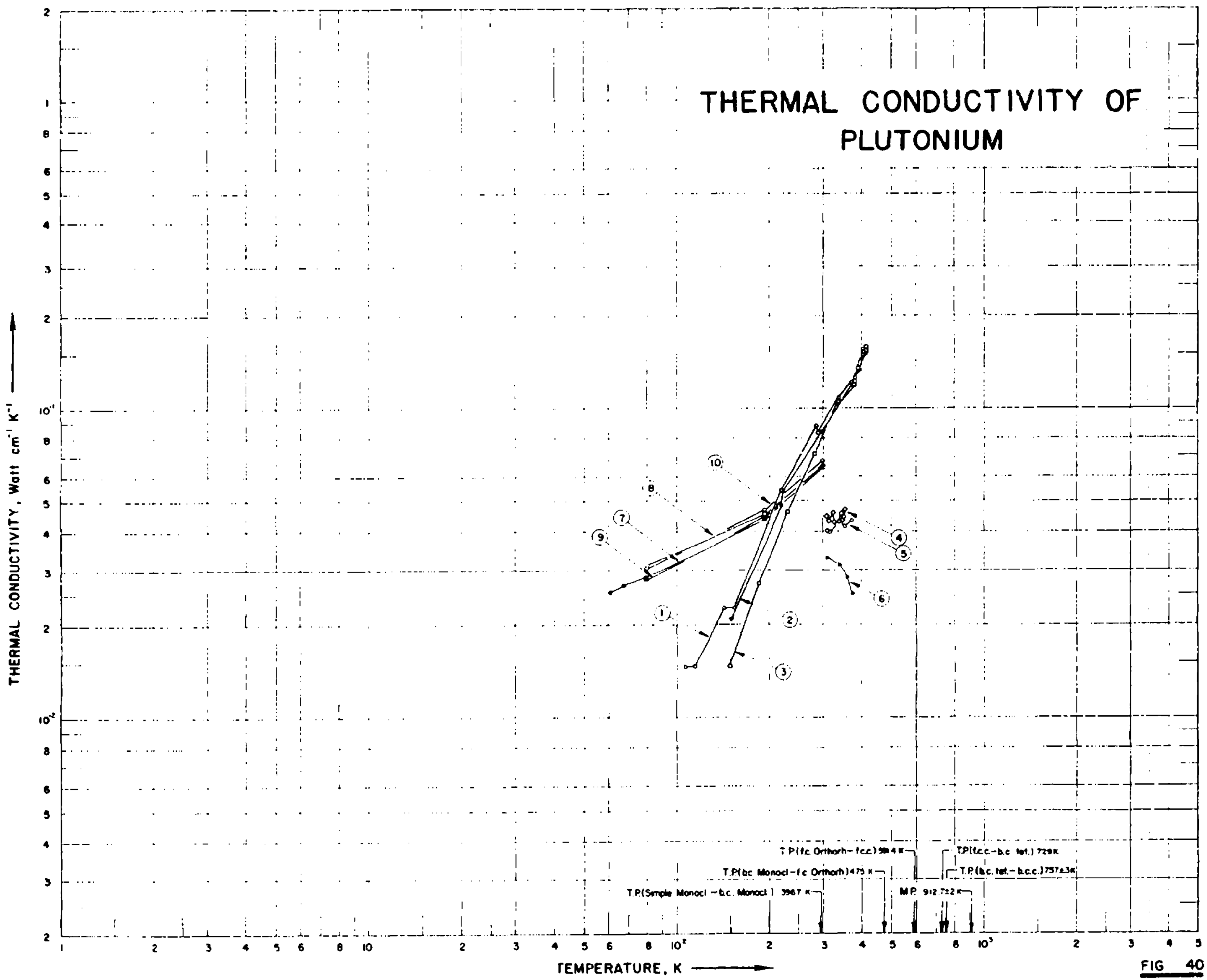

THERMAL CONDUCTIVITY OF PLUTONIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P.(f.c. Orthorh – f.c.c.) 584 K
T.P.(b.c. Monocl – f.c. Orthorh) 475 K
T.P.(Simple Monocl – b.c. Monocl.) 396.7 K
T.P.(f.c.c. – b.c. tet.) 729 K
T.P.(b.c. tet. – b.c.c.) 757±3 K
M.P. 912.7±2 K
1
2
3
4
5
6
7
8
9
10

FIG 40

SPECIFICATION TABLE NO. 40 THERMAL CONDUCTIVITY OF PLUTONIUM

(Impurity <0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 40]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	921, 373	L	1957	108-413		1	99.95 pure; isotopic content: 94.76 Pu-239, 4.91 Pu-240, 0.29 Pu-241 and 0.04 Pu-242; specimen 0.231 in. in dia and 3.50 in. long; heat generation 0.01067 cal $sec^{-1}cm^{-3}$; density 19.58 g cm^{-3}; phase transformation (α to β) at 397.0 ± 0.2 K; electrical resistivity 61.1, 128.0, 157.0, 153.5, 146.3, 141.0, 107.5, 107.0, 106.2, 105.0, 97.7, 98.5, 99.4, and 107.1 μohm cm at 27.2, 50, 100, 150, 273, 380, 420, 475, 505, 590, 625, 725, 735, and 774 K, respectively.
2	921, 373	L	1957	152-413		2	99.97 pure; isotopic content: 95.35 Pu 239, 4.37 Pu-240, 0.26 Pu-241 and 0.03 Pu 242; specimen 0.250 in. in dia and 3.50 in. long; heat generation 0.01034 cal $sec^{-1}cm^{-3}$; density 19.56 g cm^{-3}; phase transformation (α to β) at 396.4 ± 0.1 K; electrical resistivity 68.5, 128.0, 156.8, 153.5, 146.6, 141.8, 109.5, 110.0, 109.5, 109.3, 103.0, 104.0, 104.8, 114.0, and 114.1 μohm cm at 25.8, 50, 100, 150, 273, 380, 420, 475, 535, 590, 625, 725, 735, 774, and 787 K, respectively.
3	921, 373	L	1957	148-413		3	99.93 pure; isotopic content: 95.33 Pu-239, 4.39 Pu-240, 0.28 Pu-241 and 0.06 Pu-242; specimen 0.227 in. in dia and 3.75 in. long; heat generation 0.01034 (assumed) cal $sec^{-1}cm^{-3}$; density 19.53 g cm^{-3}.
4	767	L	1958	309-357	5		Impurities 0.025; α-phase; specimen 1 in. in dia and 5 in. long; zone refined; self heating used as source of power during measurement; data extracted from two runs.
5	767	E	1958	309-374	1.5		Impurities 0.025; α-phase; 1.6 in. long; 0.08 in. dia; zone refined; cast.
6	767	E	1958	309-274			The above specimen, data corrected for emissivity (assumed to be 0.3).
7	281	E	1967	62-300	1	α-Plutonium	99.98$^+$ pure; monoclinic crystalline; specimen 0.25 in. in dia and 1.81 in. long; arc-melted and induction cast into an MgO mold; density 19.62 g cm^{-3}; specimen had randomly oriented grains and a large number of microcracks.
8	281	E	1967	80-300	1	α-Plutonium	99.98$^+$ pure; monoclinic crystalline; specimen 0.25 in. in dia and 1.81 in. long; arc-melted and cast into a mold at -40 C, then annealed at 110 C; density 19.77 g cm^{-3}; specimen had randomly oriented grains and very few microcracks.
9	281	E	1967	80-300	1	α-Plutonium	99.98$^+$ pure; specimen 0.25 in. in dia and 1.80 in. long with long axis parallel to preferential alignment of the (020) plane in the monoclinic crystals; prepared by heating the cast ingot into the beta-phase temperature range and then cooling it to room temperature under a compressive load of 60,000 psi; density 19.77 g cm^{-3}.
10	281	E	1967	80-300	1	α-Plutonium	Similar to the above specimen except the long axis aligned perpendicular to the (020) plane of the monoclinic crystal.

DATA TABLE NO. 40 THERMAL CONDUCTIVITY OF PLUTONIUM

(Impurity <0.20% each; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

CURVE 1

T	k
107.5	0.0146
115.0	0.0146
143.0	0.0226
155.0	0.0226
220.0	0.0544
286.0	0.0879
288.0	0.0837
337.0	0.1088
373.0	0.1213
383.0	0.1255
405.0	0.1527
413.0	0.1548

CURVE 2

T	k
152.0	0.0209
220.0	0.0481
222.5	0.0536
295.0	0.0849
337.0	0.1021
373.0	0.1192
390.0	0.1320
405.0	0.1464
413.0	0.1506

CURVE 3

T	k
148.0	0.0146
187.0	0.0272
230.0	0.0460
280.0	0.0711
337.0	0.1050
375.0	0.1192
390.0	0.1339
405.0	0.1548
413.0	0.1590

CURVE 4

T	k
309.2	0.0448
314.7	0.0433
325.2	0.0460
328.2	0.0429

CURVE 4 (cont.)

T	k
339.2	0.0431
346.2	0.0456
348.2	0.0435
349.2	0.0448
349.7	0.0433
351.2	0.0444
356.7	0.0469

CURVE 5

T	k
309.2	0.0404
316.7	0.0400
345.7	0.0433*
354.2	0.0416
374.7	0.0433

CURVE 6

T	k
309.2	0.0331
340.2	0.0312
360.7	0.0285
374.7	0.0251

CURVE 7

T	k
61.5	0.0256
66.0	0.0268
80.0	0.0285
195.0	0.0436
300.0	0.0645

CURVE 8

T	k
80.0	0.0313
195.0	0.0452
300.0	0.0648

CURVE 9

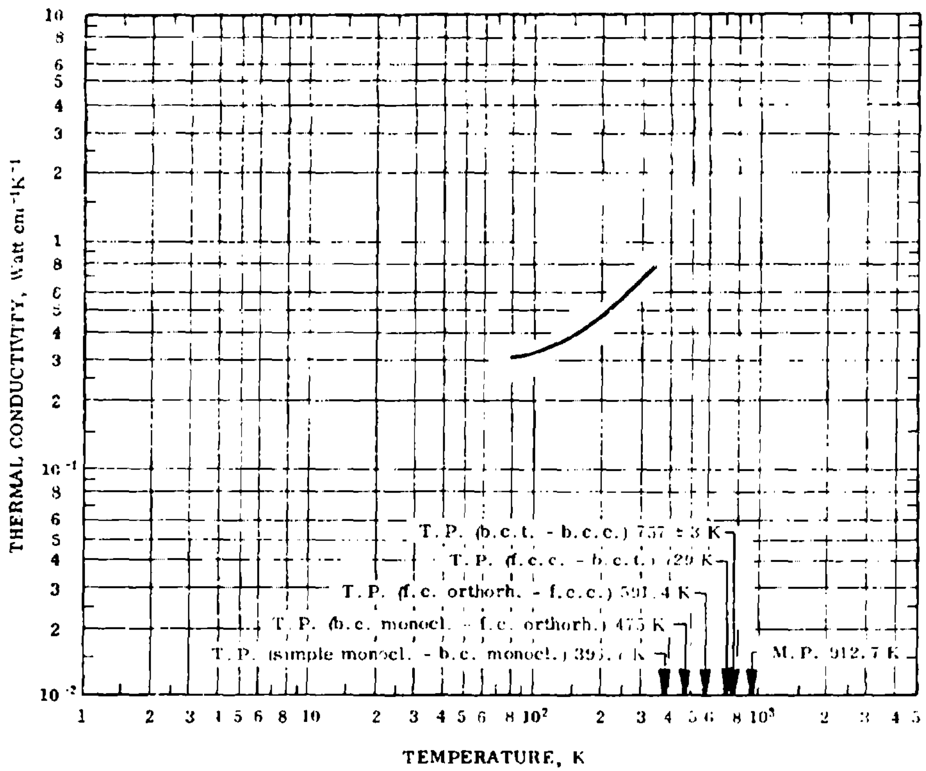
T	k
80.0	0.0281
195.0	0.0439
300.0	0.0651

CURVE 10

T	k
80.0	0.0306
195.0	0.0467
300.0	0.0674

* Not shown on plot

FIGURE AND TABLE NO. 40R RECOMMENDED THERMAL CONDUCTIVITY OF PLUTONIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
80	0.0306	1.77	-315.7
90	0.0318	1.84	-297.7
100	0.0331	1.91	-279.7
150	0.0399	2.31	-189.7
200	0.0476	2.75	- 99.7
250	0.0568	3.28	- 9.7
273.2	0.0616	3.56	32.0
300	0.0674	3.89	80.3
350	0.0790	4.56	170.3

REMARKS

The recommended values are for well-annealed 99.98% pure plutonium. The recommended values are thought to be accurate to within 10% of the true values near room temperature and 10 to 20% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

FIGURE SHOWS ONLY 21 OF THE CURVES REPORTED IN TABLE

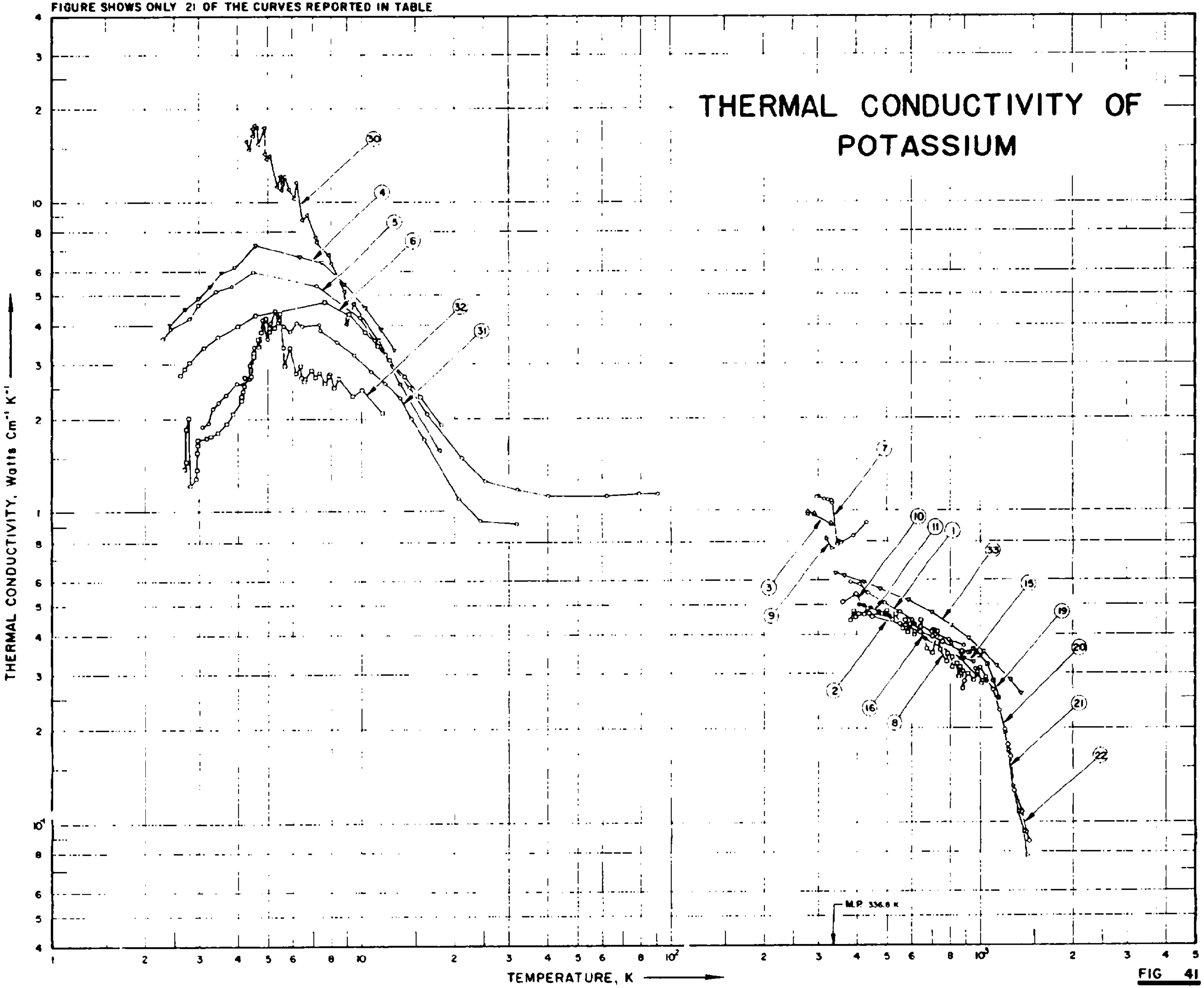


FIG 41

SPECIFICATION TABLE NO. 41 THERMAL CONDUCTIVITY OF POTASSIUM

(Impurity < 0.20% each; total impurities < 0.5%)

[For Data Reported in Figure and Table No. 41]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	105	P	1956	384-891			Pure; in liquid state; thermal conductivity values calculated from measured (in argon) thermal diffusivity data using the specific heat and density values given in Liquid Metals Handbook (Lyon, R., Editor), 2nd Edition, 1952.
2	502,38	L	1951	448-883	1		< 0.001 O, < 0.00001 each of Na, Ca, Al, Rb, and Li; distilled; in liquid state.
3	72	E	1913	278-331			Pure; trace of Na; supplied by Eimer and Amend; electrical resistivity reported as 6.492, 6.442, 7.015, 7.035, 6.980, 8.353, and 8.338 μohm cm at 5.0, 5.0, 20.6, 20.7, 20.9, 57.4, and 57.8 C, respectively.
4	92	L	1956	2.4-13		K 1	Very pure; 1.3 mm dia; electrical resistivity ratio ρ(295 K)/ρ(0 K) = 532 (using Hackspill's value ρ(295 K) = 7.08 μohm cm); Lorenz function L (0 K) = 2.55 x $10^{-8} V^2 K^{-2}$.
5	92	L	1956	2.3-91		K 2	Very pure; 2.1 mm dia; electrical resistivity ratio ρ(295 K)/ρ(0 K) = 513 (using Hackspill's value ρ(295 K) = 7.08 μ ohm cm); Lorenz function L (0 K) = 2.31 x $10^{-8} V^2 K^{-2}$.
6	92	L	1956	2.6-18		K 4	Very pure; 1.3 mm dia; electrical resistivity ratio ρ(295 K)/ρ(0 K) = 325 (using Hackspill's value ρ(295 K) = 7.08 μohm cm); Lorenz function L (0 K) = 2.49 x $10^{-8} V^2 K^{-2}$.
7	385	L	1940	298-433	2-4		Doubly distilled; measured across melting point (approx 62 C).
8	919, 592,920	L	1958	382-1007			M.P. 63.7 C; specimen in liquid state; measured in vacuum of ~ 4 x 10^{-4} mm Hg.
9	766	C	1963	319,333			0.1 Na, 0.0050 Rb, 0.0035 O, 0.0030 Li, < 0.0010 each of Cs, Zr, Fe, Co, and Ni; Nb-1 Zr alloy used as comparative material.
10	766,854, 855,856	C	1963	360-449			Liquid state; same pretest impurities as the above specimen; additional impurities after test: 0.00105 Nb and 0.00015 Zr (contaminated from specimen container, made from Nb-1 Zr alloy); electrical resistivity reported as 15.4, 21.5, 28.4, 35.8, 44.4, 54.7, 66.4, 79.5, 93.8, 110, 131, 145, and 153 μ ohm cm at 373, 473, 573, 673, 773, 873, 973, 1073, 1173, 1273, 1373, 1423, and 1448 K, respectively; Nb-1 Zr alloy used as comparative material; run A, equilibrium 1.
11	766,854, 855,856	C	1963	408-511			Run A, equilibrium 2 of the above specimen.
12	766,854, 855,856	C	1963	412-501			Run A, equilibrium 3 of the above specimen.
13	766,854, 855,856	C	1963	491-658			Run A, equilibrium 4 of the above specimen.
14	766,854, 855,856	C	1963	529-787			Run A, equilibrium 5 of the above specimen.
15	766,854, 855,856	C	1963	584-953			Run A, equilibrium 6 of the above specimen.
16	766,854, 855,856	C	1963	611-1054			Run A, equilibrium 7 of the above specimen.

SPECIFICATION TABLE NO. 41 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
17	766, 854, 855, 856	C	1963	604-822			Same specimen as above; run B, equilibrium 1.
18	766, 854, 855, 856	C	1963	745-897			Run B, equilibrium 2 of the above specimen.
19	766, 854, 855, 856	C	1963	923-1154			Run B, data set 3, reading 1 of the above specimen.
20	766, 854, 855, 856	C	1963	970-1210			Run B, data set 3, reading 2 of the above specimen.
21	766, 854, 855, 856	C	1963	1219-1435			Run B, data set 3, reading 14 of the above specimen.
22	766, 854, 855, 856	C	1963	1234-1449			Run B, data set 3, reading 15 of the above specimen.
23	148, 857		1966	700-1500	± 20		Vapor; measured in the 1 mm gap between concentric cylinders 900 mm long; vapor pressure = 0.01 kg cm^{-2}.
24	148, 857		1966	800-1500	± 20		Similar to the above except vapor pressure = 0.05 kg cm^{-2}.
25	148, 857		1966	900-1500	± 20		Similar to the above except vapor pressure = 0.1 kg cm^{-2}.
26	148, 857		1966	1000-1500	± 20		Similar to the above except vapor pressure = 0.5 kg cm^{-2}.
27	148, 857		1966	1100-1500	± 20		Similar to the above except vapor pressure = 1.0 kg cm^{-2}.
28	148, 857		1966	1100-1500	± 20		Similar to the above except vapor pressure = 2.0 kg cm^{-2}.
29	148, 857		1966	700-1100	± 20		Similar to the above except measured on saturate curve.
30	858	L	1967	4.3-18	?	K-9	99.97 pure; single crystal; rectangular specimen with length/cross-sectional area = 12; material obtained from Mine Safety Appliances Corp.; prepared by growing from the bulk material using the Bridgman technique.
31	858	L	1967	3.1-32	?	ZK-1	Originally 99.97 pure; single crystal; rectangular specimen with length to cross-sectional area ratio = 12; material obtained from Mine Safety Appliances Corp.; prepared by melting in a stainless-steel boat, zone refined at a rate of 1 in. hr^{-1} for 16 passes, grown by using the Bridgman technique. The zone refining technique is believed to have introduced impurities not present in the original bulk material.
32	858	L	1967	2.7-12	?	ZK-2	Similar to the above specimen
33	859, 860, 861	–	1965	341-1366			Specimen in liquid state; density reported as 0.7851, 0.7434, 0.7161, 0.6887, 0.6664, 0.6276, 0.6024, and 0.5861 g cm^{-3} at 520.5, 701.3, 827.7, 944.3, 1048, 1206, 1302, and 1374 K, respectively; electrical resistivity reported as 7.02, 7.32, 7.54, 8.05, 15.05, 17.96, 20.31, 24.83, 28.34, 32.64, 37.84, 41.43, 47.70, 51.81, 58.51, 65.94, 71.44, 81.18, 87.82, 98.61, 106.63, 119.87, and 130.61 μohm at 296, 309, 314, 329, 376, 431, 476, 541, 591, 648, 712, 755, 822, 863, 926, 988, 1031, 1102, 1144, 1210, 1253, 1319 and 1365 K, respectively; thermal conductivity values calculated from measured electrical resistivity data and the Lorenz number 2.45 x 10^{-8} V^2K^{-2}.

SPECIFICATION TABLE NO. 41 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
34	766, 855	-	1963	373-1423	< ± 2		Thermal conductivity values calculated from the measurements of electrical resistivity, reported as 15.4, 21.5, 28.4, 35.8, 44.4, 54.7, 66.4, 74.2, 79.5, 93.8, 110, 131, and 145 μ ohm cm at 100, 200, 300, 400, 500, 600, 700, 760, 800, 900, 1000, 1100, and 1150 C, respectively; Lorenz Number assumed to be 2.14 x 10^{-8} V^2K^{-2} based upon experimental information.
35	863	-	1966	845.2		Run No. 1	Vapor specimen filled in a test cell 8 in. long connected with a boiler; boiler pressure ~ 10 mm Hg; thermal conductivity measured by using the dynamic hot-wire method.
36	863	-	1966	847.2		Run No. 2	Same as above except boiler pressure 37 mm Hg.
37	863	-	1966	914.2		Run No. 3	Same as above except boiler pressure 72 mm Hg.
38	863	-	1966	978.2		Run No. 4	Same as above except boiler pressure 80 mm Hg.
39	863	-	1966	983.2		Run No. 5	Same as above; in different run.
40	863	-	1966	1034		Run No. 6	Same as above except boiler pressure 78 mm Hg.
41	863	-	1966	1035		Run No. 7	Same as above except boiler pressure 1417 mm Hg.
42	863	-	1966	1036		Run No. 8	Same as above; in different run.
43	863	-	1966	1116		Run No. 9	Same as above except boiler pressure 1144 mm Hg.
44	756	-	1962	473-1073			0.32 Na, 0.02 Fe, and 0.004 O (posttest); molten specimen contained in a type 347 stainless-steel tube; supplied by Fisher Scientific Co.; electrical resistivity 8.07, 8.24, 8.59, 8.82, 9.47, 9.81, 14.77, 15.48, 17.90, 21.86, 26.06, 29.57, 34.11, 38.32, 43.30, 48.47, 54.04, 59.47, 60.02, 66.75, and 74.30 μohm cm at 25.3, 29.4, 38.3, 51.4, 58.3, 59.2, 79.4, 91.9, 140.8, 205.0, 256.4, 313.9, 373.6, 429.2, 481.9, 542.8, 593.3, 646.9, 651.4, 706.7, and 764.2 C, respectively; thermal conductivity values calculated from measured electrical resistivity data and the Lorenz function of 2.07, 2.11, 2.14, 2.17, 2.21, 2.29, and 2.34 x 10^{-8} V^2K^{-2} at 200, 300, 400, 500, 600, 700, and 750 C, respectively, the first five values being derived from the thermal conductivity measurements of Ewing, C.T. and Grand, J.A. (NRL Report 3835, 1951) and the authors' own electrical resistivity data.

DATA TABLE NO. 41 THERMAL CONDUCTIVITY OF POTASSIUM

(Impurity 0.02% each; total impurities 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
383.8	0.591
408.5	0.581
435.6	0.545
490.8	0.506
554.4	0.472
606.1	0.444
697.9	0.407
794.4	0.384
890.8	0.368
CURVE 2	
448.0	0.455
549.6	0.431
641.9	0.408
700.0	0.394
757.2	0.377
875.2	0.353
883.1	0.352
CURVE 3	
278.2	0.971
278.2	0.992
293.8	0.979
293.9	0.962
294.1	0.971
330.6	0.904
331.0	0.912
CURVE 4	
2.42	4.046
2.71	4.529
2.99	4.897
3.27	5.333
3.55	5.908
3.93	6.200
4.58	7.287
6.35	5.690
7.46	6.437
CURVE 4 (cont.)	
8.84	5.407
10.30	4.552
11.70	3.862
12.80	3.333
CURVE 5	
2.29	3.632
2.43	3.908
2.80	4.207
2.99	4.667
3.40	5.126
3.83	5.333
4.49	5.954
7.20	5.345
9.91	4.230
11.03	3.586
12.06	3.218
14.40	2.506
16.39	2.069
21.20	1.494
25.23	1.264
32.06	1.180
40.10	1.126
62.30	1.126
79.00	1.149
91.00	1.149
CURVE 6	
2.62	2.759
2.70	2.897
2.80	3.034
3.11	3.379
3.46	3.655
4.02	3.977
4.58	4.390
7.66	4.713
9.16	4.345
10.37	3.793
11.40	3.425
CURVE 6 (cont.)	
12.43	3.680
13.83	2.713
15.60	2.345
18.13	1.908
CURVE 7	
297.7	1.103
298.7	1.102
314.0	1.09
323.2	1.08
330.7	1.07
331.2	1.065
333.2	1.06
346.2	0.785
347.2	0.795
348.2	0.798
354.7	0.792
355.7	0.792
390.7	0.835
391.2	0.835
433.2	0.910
CURVE 8	
382.2	0.442
389.2	0.451
394.2	0.477
398.2	0.451
403.2	0.465
409.2	0.465
413.2	0.460
421.2	0.464
428.2	0.464
434.2	0.485
440.7	0.465
447.2	0.477
453.2	0.475
455.2	0.451
459.2	0.453
463.2	0.466
CURVE 8 (cont.)	
466.2	0.477
473.7	0.488
474.2	0.457
480.2	0.459
483.2	0.465
489.2	0.464
493.2	0.456
497.2	0.451
500.7	0.473
506.2	0.451
509.2	0.465
518.2	0.464
522.2	0.442
529.2	0.438
533.7	0.439
534.2	0.463
538.7	0.446
543.2	0.460
553.2	0.430
553.7	0.452
561.2	0.418
568.2	0.430
571.2	0.442
587.2	0.407
595.2	0.397
598.7	0.430
604.2	0.430
610.2	0.444
613.7	0.399
619.7	0.435
624.2	0.418
629.2	0.404
633.2	0.414
638.2	0.401
641.2	0.420
646.2	0.442
657.2	0.414
660.2	0.416
663.2	0.397
664.2	0.418
669.2	0.395
CURVE 8 (cont.)	
674.2	0.360
676.7	0.413
677.2	0.389
699.2	0.403
709.7	0.349
710.6	0.384
713.2	0.404
715.7	0.378
723.2	0.372
726.2	0.378
730.2	0.372
730.7	0.407
735.2	0.395
735.7	0.363
745.7	0.356
746.2	0.386
759.2	0.348
768.2	0.358
785.2	0.328
787.7	0.349
790.7	0.374
799.2	0.342
799.7	0.321
814.2	0.339
818.2	0.314
819.5	0.339
826.2	0.308
845.2	0.323
855.2	0.322
856.7	0.291
863.7	0.315
864.2	0.294
884.2	0.305
888.2	0.267
893.2	0.281
916.2	0.298
924.2	0.291
944.2	0.289
958.2	0.285
983.2	0.303
1007.2	0.277
CURVE 9	
311.2	0.817
333.2	0.760
CURVE 10	
360.2	0.508
398.2	0.541
427.2	0.469*
449.2	0.477*
CURVE 11	
408.2	0.499
422.2	0.496
444.2	0.485
473.2	0.474
495.2	0.462
511.2	0.456
CURVE 12*	
412.2	0.500
427.2	0.497
449.2	0.490
478.2	0.500
501.2	0.435
CURVE 13*	
491.2	0.473
519.2	0.449
561.2	0.464
615.2	0.465
658.2	0.407
CURVE 14*	
529.2	0.462
564.2	0.422
617.2	0.430
689.2	0.402
CURVE 14 (cont.)*	
747.2	0.373
787.2	0.375
CURVE 15	
584.2	0.451*
632.2	0.412*
707.2	0.411
809.2	0.375
893.2	0.336
953.2	0.326
CURVE 16	
611.2	0.434
667.2	0.386
754.2	0.381
877.2	0.336
979.2	0.295
1054.2	0.282
CURVE 17*	
604.2	0.431
633.2	0.423
678.2	0.407
740.2	0.384
788.2	0.363
822.2	0.338
CURVE 18*	
745.2	0.399
766.2	0.389
797.2	0.390
840.2	0.361
874.2	0.358
897.2	0.338

* Not shown on plot

DATA TABLE NO. 41 (continued)

T	k
CURVE 19	
922.2	0.350
[illegible]	[illegible]
995.2	0.343
1064.2	0.321
1116.2	0.283
1154.2	0.249
CURVE 20	
970.2	0.310
1001.2	0.312
1048.2	0.291
1114.2	0.265
1169.2	0.227
1210.2	0.197
CURVE 21	
1219.2	0.154
1242.2	0.170
1282.2	0.130
1346.2	0.108
1397.2	0.094
1435.2	0.078
CURVE 22	
1234.2	0.176
1257.2	0.162
1299.2	0.125
1361.2	0.109
1412.2	0.093
1449.2	0.087
CURVE 23*	
700	0.000169
800	0.000141
900	0.000149
1000	0.000162
1100	0.000177
1200	0.000192
1300	0.000206
1400	0.000222
1500	0.000236

T	k
CURVE 24*	
800	0.000201
900	0.000172
1000	0.000171
1100	0.000180
1200	0.000194
1300	0.000208
1400	0.000223
1500	0.000238
CURVE 25*	
900	0.000197
1000	0.000183
1100	0.000186
1200	0.000198
1300	0.000209
1400	0.000224
1500	0.000239
CURVE 26*	
1000	0.000259
1100	0.000227
1200	0.000220
1300	0.000223
1400	0.000234
1500	0.000247
CURVE 27*	
1100	0.000270
1200	0.000245
1300	0.000241
1400	0.000244
1500	0.000252
CURVE 28*	
1100	0.000322
1200	0.000290
1300	0.000269
1400	0.000264
1500	0.000267

T	k
CURVE 29*	
700	0.000166
800	0.000210
900	0.000251
1000	0.000288
1100	0.000320
CURVE 30	
4.29	15.7
4.37	14.8
4.48	17.4
4.49	15.9*
4.49	16.5
4.53	17.8
4.54	16.9*
4.63	17.5
4.67	15.4
4.87	17.5
4.92	14.3
4.99	13.8
5.12	14.1
5.13	14.3*
5.36	11.3
5.51	11.6*
5.51	12.2
5.56	11.9
5.62	11.6
5.66	12.1
5.89	11.0
6.11	10.2
6.20	11.6
6.49	8.73
6.73	9.04
7.18	7.67
7.23	7.40
7.89	6.76
8.02	6.35
8.85	5.13
9.00	4.04
9.49	4.70
11.4	3.57
13.4	2.58
17.9	1.57

T	k
CURVE 31	
3.06	1.98
3.21	1.94
3.33	2.16
3.48	2.25
3.66	2.38
3.98	2.59
4.19	2.77
4.38	2.65
4.39	2.97
4.54	3.40
4.71	3.58
4.84	4.19
5.00	3.61
5.12	4.06
5.30	4.46
5.42	4.09
5.66	3.97
5.92	3.82
6.21	4.05
6.46	3.98
7.35	4.03
7.40	3.86
8.40	3.73
9.73	3.20
10.8	2.84
12.0	2.59
13.4	2.32
14.6	2.00
16.1	1.71
20.7	1.10
24.4	0.933
31.9	0.912
CURVE 32	
2.69	1.38
2.72	1.46
2.72	1.86
2.77	2.01
2.81	1.22
2.94	1.29
2.96	1.37
2.96	1.56
2.98	1.65
2.98	1.71

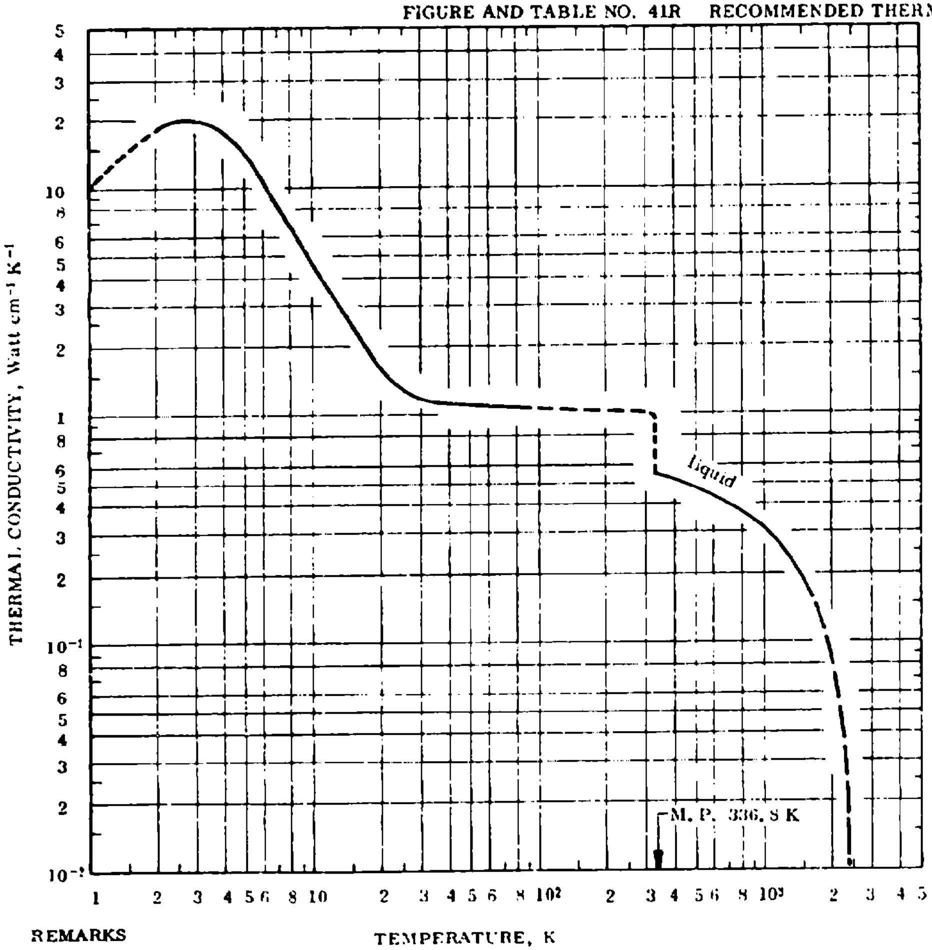
T	k
CURVE 32 (cont.)	
3.17	1.73
3.27	1.76
3.45	1.80
3.67	1.92
3.86	2.07
4.13	2.27
4.13	2.35
4.16	2.44
4.20	2.54
4.23	2.71
4.41	2.73
4.50	3.18
4.50	3.25
4.65	3.60
4.68	3.40
4.77	3.80
4.79	3.86*
4.92	4.23
5.08	3.93
5.08	3.82
5.28	3.93
5.49	4.36
5.64	3.39
5.69	2.95
5.89	3.37
6.16	2.79
6.39	2.95
6.44	2.70
6.58	2.63
6.61	2.68
6.51	2.86
7.12	2.71
7.35	2.79
7.65	2.57
7.89	2.73
7.95	2.78
8.20	2.49
8.47	2.68
9.36	2.35
10.1	2.46
11.7	2.08
CURVE 33	
341	0.631

T	k
CURVE 33 (cont.)	
366	0.619
422	0.591
478	0.563
589	0.516
700	0.470
811	0.426
922	0.387
1033	0.352
1144	0.317
1255	0.286
1366	0.257
CURVE 34*	
373.2	0.519
473.2	0.471
673.2	0.402
873.2	0.342
1073	0.289
1173	0.268
1273	0.247
1373	0.225
1423	0.210
CURVE 35*	
845.2	0.000196
CURVE 36*	
847.2	0.000186
CURVE 37*	
914.2	0.000266
CURVE 38*	
978.2	0.000227
CURVE 39*	
983.2	0.000308

T	k
CURVE 40*	
1034	0.000227
CURVE 41*	
1035	0.000237
CURVE 42*	
1036	0.000240
CURVE 43*	
1116	0.000250
CURVE 44*	
473.2	0.458
549.2	0.434
609.2	0.417
683.2	0.398
750.2	0.380
836.2	0.362
905.2	0.350
990.2	0.338
1073	0.328

* Not shown on plot

FIGURE AND TABLE NO. 41R RECOMMENDED THERMAL CONDUCTIVITY OF POTASSIUM



REMARKS

The recommended values are for 99.97+% pure potassium with residual electrical resistivity ρ_0 = 0.00237 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 80 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, α' = 2.06 x 10^{-3}, and β = 0.0973. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1 (In Liquid State)	k_2	T_2
0	0	0	-459.7	336.8	0.548	31.7	146.6
1	(10.1)‡	(584)	-457.9	350	0.542	31.3	170.3
2	(17.6)	(1020)	-456.1	400	0.520	30.0	260.3
3	19.6	1130	-454.3				
4	17.5	1010	-452.5				
5	14.0	809	-450.7	500	0.479	27.7	440.3
6	10.8	624	-448.9	600	0.439	25.4	620.3
7	8.33	481	-447.1	700	0.404	23.3	800.3
8	6.62	383	-445.3	800	0.371	21.4	980.3
9	5.42	313	-443.5	900	0.340	19.6	1160
10	4.58	265	-441.7	1000	0.313	18.1	1340
11	3.97	229	-439.9	1100	0.287	16.6	1520
12	3.47	200	-438.1	1200	0.263	15.2	1700
13	3.06	177	-436.3	1300	0.239	13.8	1880
14	2.74	158	-434.5	1400	0.215	12.4	2060
15	2.48	143	-432.7	1500	(0.192)	(11.1)	2240
16	2.26	131	-430.9	1600	(0.170)	(9.82)	2420
18	1.91	110	-427.3	1700	(0.149)	(8.61)	2600
20	1.67	96.5	-423.7	1800	(0.128)	(7.40)	2780
25	1.33	76.8	-414.7	1900	(0.108)	(6.24)	2960
30	1.23	71.1	-405.7	2000	(0.088)	(5.08)	3140
35	1.18	68.2	-396.7	2100	(0.068)	(3.93)	3320
40	1.15	66.4	-387.7	2200	(0.049)	(2.83)	3500
45	1.13	65.3	-378.7	2300	(0.029)	(1.68)	3680
50	1.12	64.7	-369.7	2400	(0.010)	(0.58)	3860
60	1.10	63.6	-351.7	2450	(0.0008)	(0.046)	3950
70	1.09	63.0	-333.7				
80	1.08	62.4	-315.7				
90	1.08	62.4	-297.7				
100	(1.07)	(61.8)	-279.7				
150	(1.05)	(60.7)	-189.7				
200	(1.04)	(60.1)	- 99.7				
250	(1.04)	(60.1)	- 9.7				
273.2	(1.04)	(60.1)	32.0				
300	1.02	58.9	80.3				
336.8	0.985	56.9	146.6				

*T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}.

‡Values in parentheses are extrapolated, interpolated, or estimated.

THERMAL CONDUCTIVITY OF PRASEODYMIUM

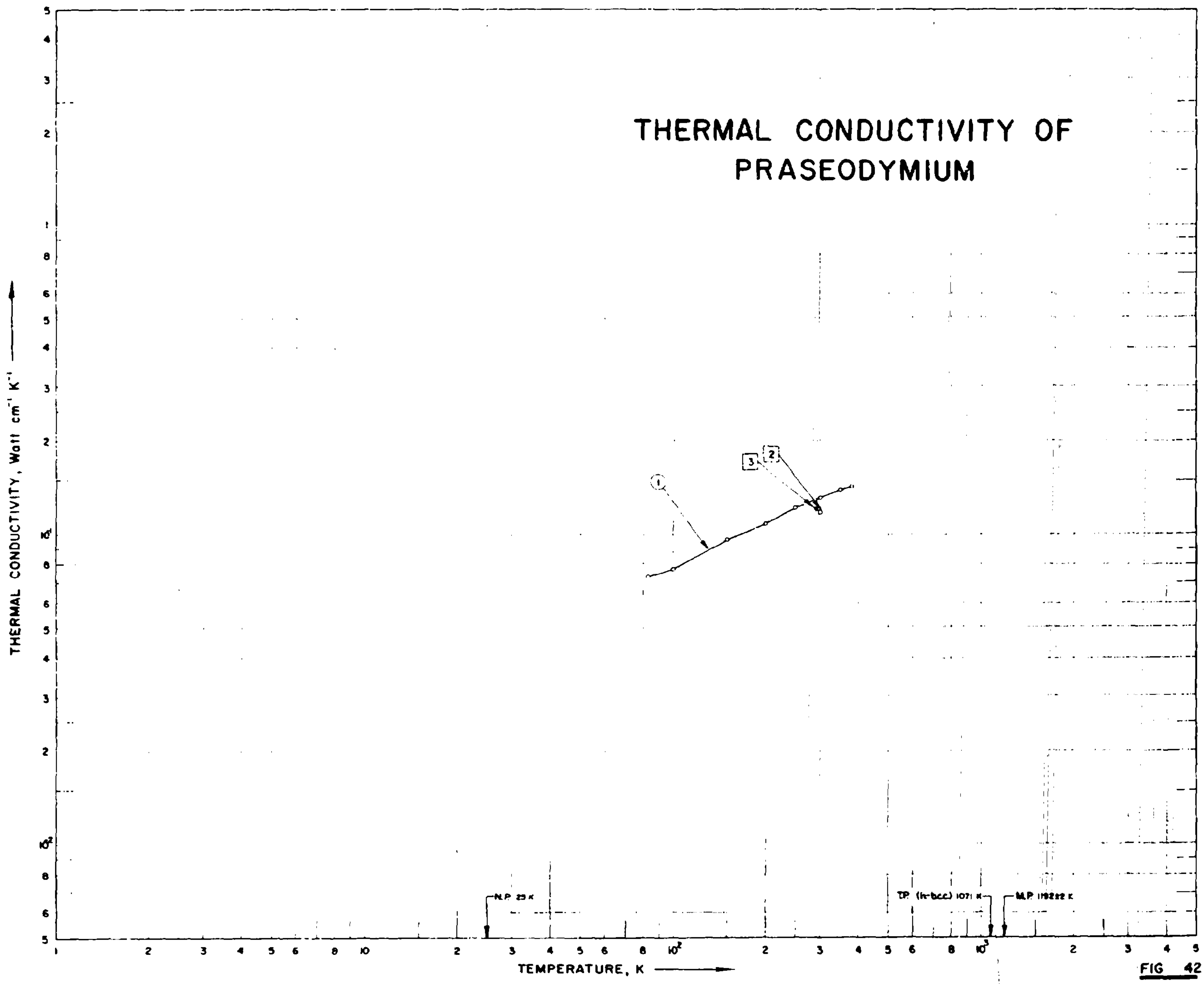


FIG 42

SPECIFICATION TABLE NO. 42 THERMAL CONDUCTIVITY OF PRASEODYMIUM

[For Data Reported in Figure and Table No. 42]

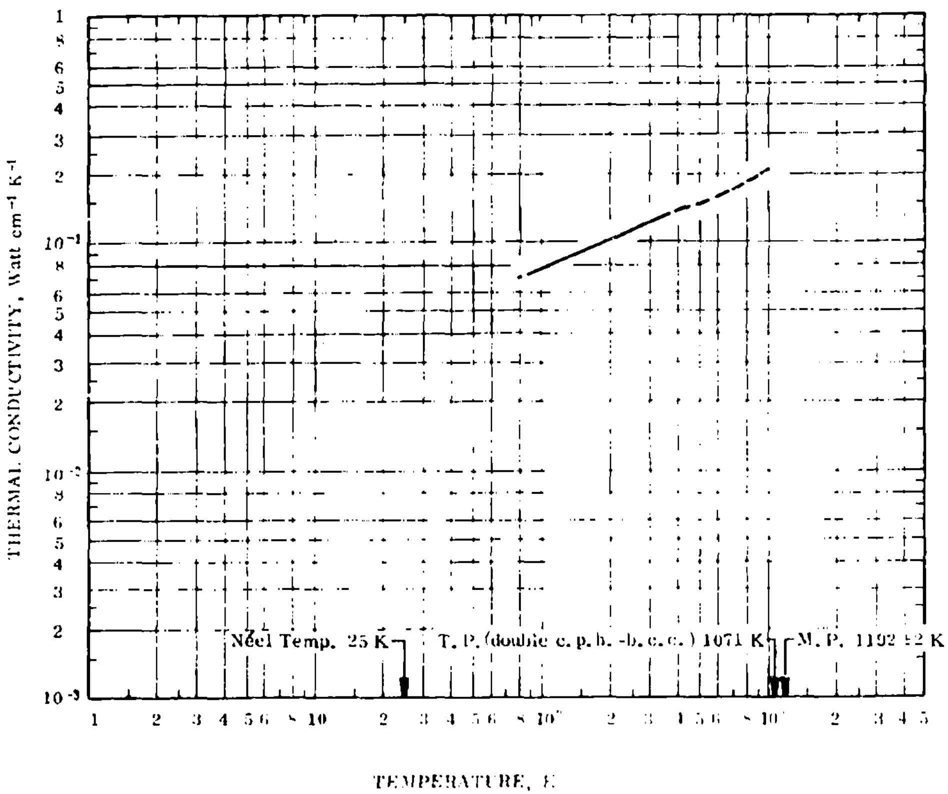
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	810	I	1964	83-360			Impurities: 0.5 La, 0.04 Cu, 0.03 Fe, and 0.01 Ca; prepared by briquetting powder under a pressure of approx 8000 Kg cm^{-2} and annealing in vacuo (~1 x 10^{-4} mm Hg) for 1-2 hrs at 1600-1800 C; measured in vacuo of ~5 x 10^{-6} mm Hg; data taken from smoothed curve of measurements on several specimens.
2	811		1954	301	10		No details reported.
3	256	C	1966	291	± 4		~0.1 Ta, ~0.1 other rare earth metals, and ~0.03 other base metals; high purity polycrystalline specimen 1 cm in dia, 1.2 cm long; electrical resistivity 66 μohm cm at 291 K; data proposed by the author from measurements of 2 different thermal comparators.

DATA TABLE NO. 42 THERMAL CONDUCTIVITY OF PRASEODYMIUM

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
83.0	0.0728
100.0	0.0768
150.0	0.0962
200.0	0.108
250.0	0.121
300.0	0.131
350.0	0.139
380.0	0.143
CURVE 2	
301.0	0.117
CURVE 3	
291.0	0.120

FIGURE AND TABLE NO. 42R RECOMMENDED THERMAL CONDUCTIVITY OF PRASEODYMIUM



RECOMMENDED VALUES[‡]
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
80	(0.0692)[‡]	(4.00)	-315.7
90	0.0732	4.23	-297.7
100	0.0769	4.44	-279.7
150	0.0926	5.35	-189.7
200	0.106	6.12	- 99.7
250	0.116	6.70	- 9.7
273.2	0.120	6.93	32.0
300	0.125	7.22	80.3
350	0.132	7.63	170.3
400	(0.136)	(7.86)	260.3
500	(0.147)	(8.49)	440.3
600	(0.157)	(9.07)	620.3
700	(0.169)	(9.76)	800.3
800	(0.184)	(10.6)	980.3
900	(0.200)	(11.6)	1160
1000	(0.216)	(12.5)	1340

REMARKS

The recommended values are for well-annealed 99.4% praseodymium. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}.

[‡]Values in parentheses are extrapolated or estimated.

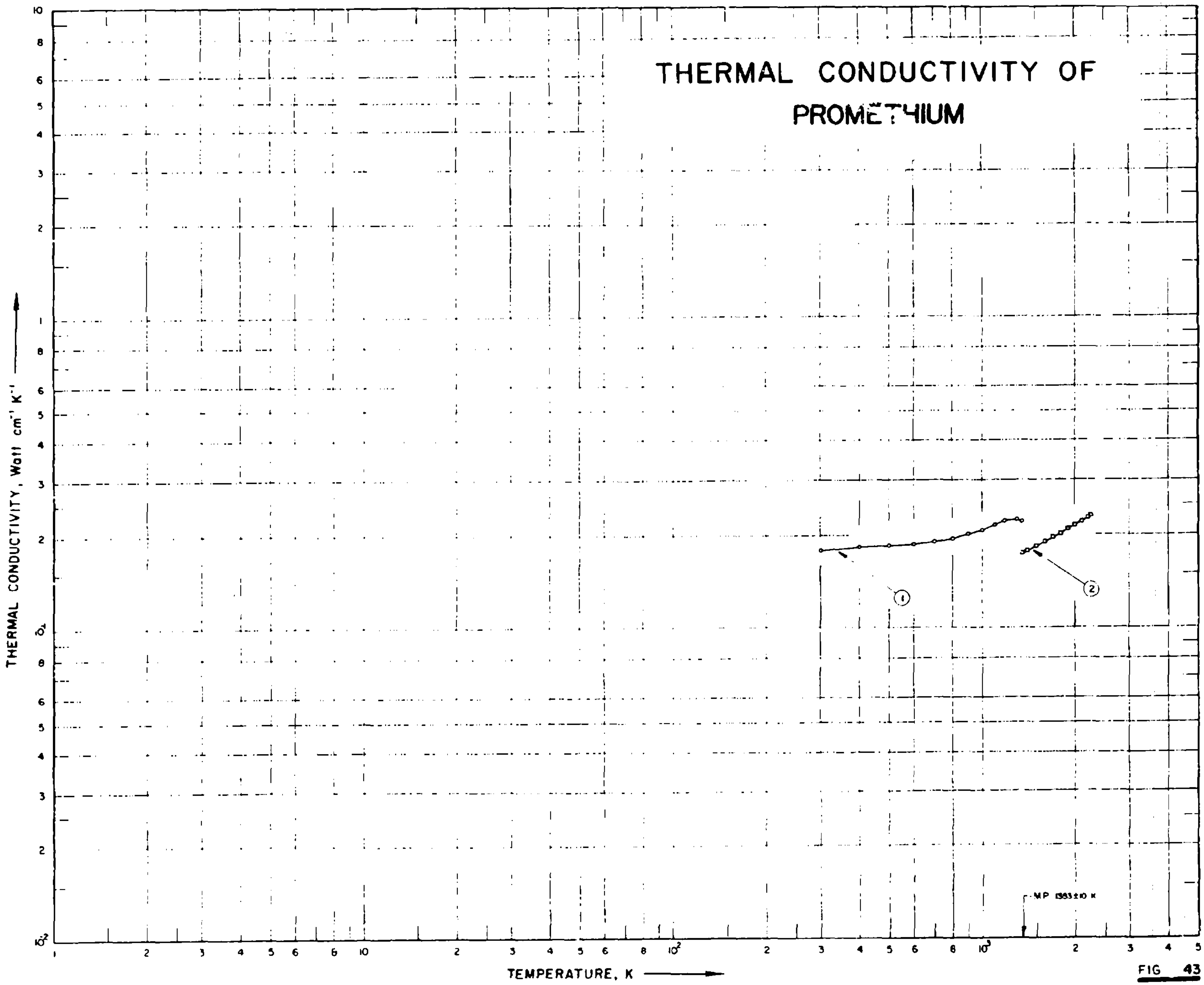

THERMAL CONDUCTIVITY OF
PROMETHIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
MP 1353±10 K
1
2

FIG 43

SPECIFICATION TABLE NO. 43 THERMAL CONDUCTIVITY OF PROMETHIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 43]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	999	–	1966	300-1353			Solid state; estimated thermal conductivity values given as the sum of electronic thermal conductivity and lattice thermal conductivity where electronic thermal conductivity values calculated from the theoretical Lorenz number $L_0 = 2.443 \times 10^{-8}\ V^2K^{-2}$ and the estimated electrical resistivity reported as 54.0, 68.0, 80.0, 92.0, 102.0, 111.5, 120.5, 128.0, 134.5, 139.0 (α), 146.0 (β), 149.0, and 152.0 μohm cm at 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1185, 1185, 1300, and 1353 K, respectively, and lattice thermal conductivity calculated from the empirical equation $k_L = 16\ T^{-1}$; c.p.h. to b.c.c. transformation temp estimated to be 1185 K; Neel temp estimated to be 6 K.
2	999	–	1966	1353-2253			Liquid state; estimated thermal conductivity values given as the sum of electronic thermal conductivity and phonon conductivity where electronic thermal conductivity values calculated from estimated values of Lorenz number, and electrical resistivity, whereas phonon conductivity values ranging from 0.004 to 0.012 W cm^{-1} C^{-1} being based on predictions due to Rao, M.R. (Phys. Rev., 59, 212, 1941), Turnbull, A.G. (Aust. J. Appl. Sci., 12, 324-29, 1961) and Powell, R.W. (Amer. Soc. Mech. Engrs., 289-95, 1965); approx mean conductivity values given by $k = 0.110 + 6.0 \times 10^{-5}T(C)$ W cm^{-1} C^{-1}.

DATA TABLE NO. 43 THERMAL CONDUCTIVITY OF PROMETHIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
300	0.179
400	0.184
500	0.185
600	0.187
700	0.191
800	0.195
900	0.201
1000	0.207
1100	0.215
1185	0.222
1185	0.213
1300	0.223
1353	0.230
CURVE 2	
1353	0.175
1400	0.178
1500	0.184
1600	0.190
1700	0.196
1800	0.202
1900	0.208
2000	0.214
2100	0.220
2200	0.226
2253	0.229

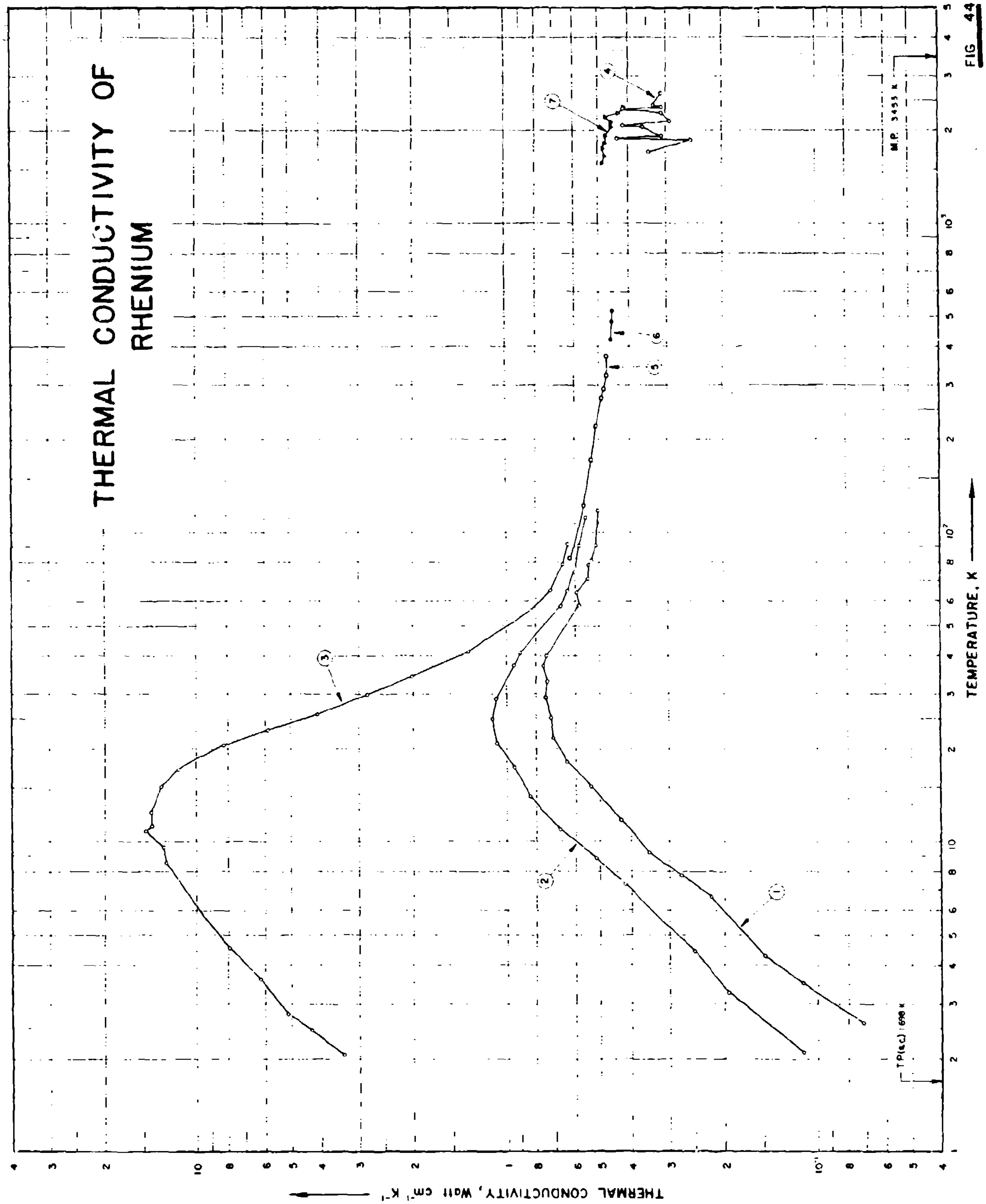

THERMAL CONDUCTIVITY OF RHENIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 3453 K
T P(s.c.) 698 K

FIG 44

SPECIFICATION TABLE NO. 44 THERMAL CONDUCTIVITY OF RHENIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 44]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	150	L	1957	2.6-118		Re 1	99.5% Re, total metallic impurities < 0.1, consisting of Cu, Fe, and Mo; cut from a rolled sheet 0.75 mm thick supplied by A.D. Mackay Inc.; density 21.3 g cm^{-3} at room temp; residual electrical resistivity 0.87 μohm cm; electrical resistivity ratio $\rho(295K)/\rho_0$ = 24.9.
2	150	L	1957	2.1-112		Re 2	Cut from the same sheet as the above specimen; annealed in vacuo at 700 C for 2 hrs; residual electrical resistivity 0.469 μohm cm; electrical resistivity ratio $\rho(295K)/\rho_0$ = 40.7.
3	150	L	1957	2.1-92		Re 4	Total impurities < 0.01; prepared by zone-melting rhenium powder in an argon arc furnace; 6 mm dia x 5-8 cm long; residual electrical resistivity 0.0139 μohm cm; electrical resistivity ratio $\rho(295K)/\rho_0$ = 1357.
4	667	E	1962	1700-2650	10		Spectrographically pure; 0.10 in. dia; electrical resistivity reported as 75.2, 84.9, 92.0, 95.2, 100.0, 103.9, 106.5, 108.3, 109.5, and 110.1 μohm cm at 1130, 1410, 1630, 1815, 1975, 2115, 2250, 2370, 2495, and 2605 K, respectively; measured in a vacuum of < 10^{-5} mm Hg.
5	610	L	1963	83-373			High purity; traces of noble metals; 7.0 cm long, 0.486 cm in dia; supplied by Johnson Matthey Co.; heat treated at 1390 C; electrical resistivity reported as 2.9, 5.8, 9.6, 13.3, 17.2, 18.8, 21.2, 24.9, 28.8, 32.6, and 36.1 μohm cm at 83, 123, 173, 223, 273, 293, 323, 373, 423, 473, and 523 K; residual electrical resistivity 0.078 μohm cm; density 20.98 g cm^{-3}; data taken from smooth curve.
6	610	C	1963	423-523			The above specimen measured by comparative method using Armco iron as comparative material; data taken from smoothed curve.
7	849	--	1966	1577-2397			0.0047 C and 0.001116 O; hexagonal; specimen 1.0711 cm in dia and 0.1582 cm thick; density 20.97 g cm^{-3}; thermal conductivity derived from the temp distribution on the flat surface of the cylindrical disc specimen heated in high vacuum (10^{-5} mm Hg) by high frequency induction generating localized heating within 0.003 in. of the surface at current frequency of 500,000 cps with heat lost only be radiation; the cylindrical surface being assumed isothermal, and the temp gradient along the radius was analytically correlated to the thermal conductivity.

DATA TABLE NO. 44 THERMAL CONDUCTIVITY OF RHENIUM

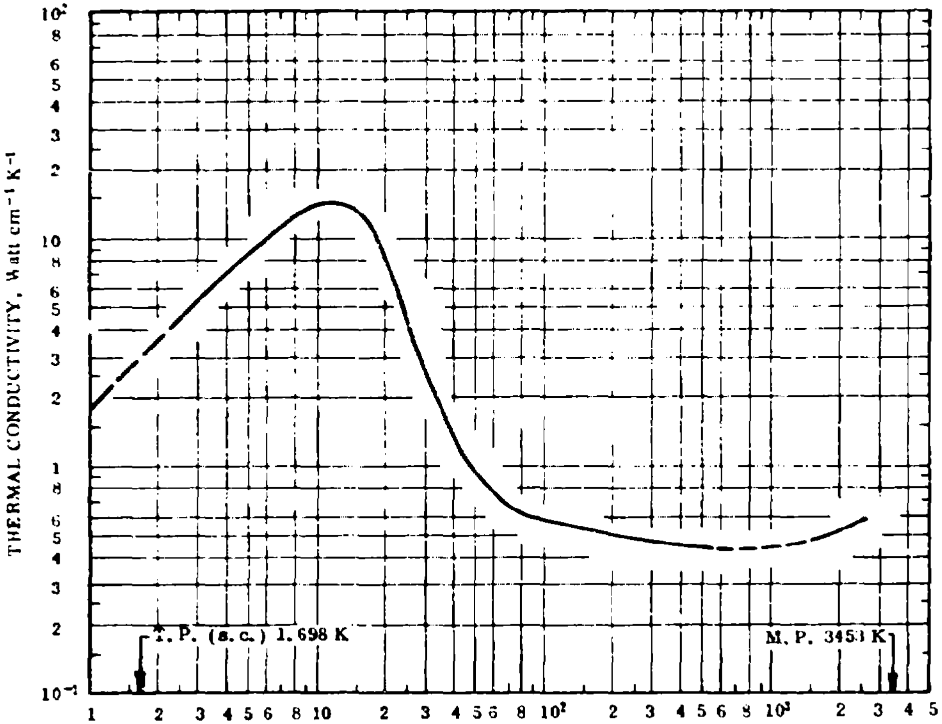
(Impurity <0.20% each, total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k	T	k
CURVE 1		**CURVE 3**		**CURVE 5**	
2.60	0.0718	2.05	[illegible]	83	0.62
3.51	0.113	2.46	4.308	123	0.56
4.29	0.149	2.77	5.128	173	0.53
5.62	0.221	3.59	6.256	223	0.51
[illegible]	0.277	4.51	7.950	273	0.49
[illegible]	0.349	8.51	12.720	293	0.48
[illegible]	0.433	9.54	13.025	323	0.47
[illegible]	0.538	10.67	14.670	373	0.47
18.20	0.641	11.18	14.050		
21.56	0.708	12.51	14.050	**CURVE 6**	
25.29	0.718	15.08	13.230		
29.35	0.749	17.23	[illegible]	423	0.455
33.00	0.738	20.50	[illegible]	473	0.450
37.14	0.759	22.87	5.84	523	0.448
40.13	0.738	25.90	4.103		
58.05	0.585	29.87	2.820	**CURVE 7**	
64.16	0.595	34.30	2.020		
70.91	0.544	41.39	1.333	1577	0.483
78.40	0.544	56.10	0.831	1667	0.473
81.30	0.533	65.20	0.718	[illegible]	0.480
90.90	0.513	79.04	0.656	[illegible]	0.472
117.70	0.503	91.70	0.636	1530	0.471
				2065	0.450
CURVE 2		**CURVE 4**		2142.5	0.450
				2166	0.448*
2.08	0.113	1700	[illegible]	2226	0.471
3.25	0.195	1855	0.251	[illegible]	0.428
4.42	0.251	1895	0.439	2397	0.411
7.27	0.423	1910	0.314		
8.83	0.513	2050	0.364		
10.91	0.677	2085	0.418		
14.03	0.841	2150	0.293		
17.40	0.954	2290	0.314		
[illegible]	1.067	[illegible]	0.418		
24.94	1.108	2390	0.314		
[illegible]	1.072	2420	0.335		
[illegible]	0.954	2650	0.314		
[illegible]	[illegible]				
[illegible]	0.667				
64.90	0.637				
76.40	0.605				
90.26	[illegible]				
112.20	[illegible]				

* Not shown on plot

FIGURE AND TABLE NO. 44R RECOMMENDED THERMAL CONDUCTIVITY OF RHENIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.448	25.9	440.3
1	(1.75)‡	(101)	-457.9	600	(0.442)	(25.5)	620.3
2	(3.51)	(203)	-456.1	700	(0.440)	(25.4)	800.3
3	5.25	303	-454.3	800	(0.441)	(25.5)	980.3
4	6.95	402	-452.5	900	(0.443)	(25.6)	1160
5	8.55	496	-450.7	1000	(0.446)	(25.8)	1340
6	10.1	584	-448.9	1100	(0.451)	(26.1)	1520
7	11.5	664	-447.1	1200	(0.457)	(26.4)	1700
8	12.6	728	-445.3	1300	(0.464)	(26.8)	1880
9	13.4	774	-443.5	1400	(0.471)	(27.2)	2060
10	14.0	809	-441.7	1500	(0.478)	(27.6)	2240
11	14.3	826	-439.9	1600	0.486	28.1	2420
12	14.2	820	-438.1	1700	0.493	28.5	2600
13	14.0	809	-436.3	1800	0.500	28.9	2780
14	13.5	780	-434.5	1900	0.509	29.4	2960
15	12.9	745	-432.7	2000	0.519	30.0	3140
16	12.1	699	-430.9	2200	0.539	31.1	3500
18	10.3	595	-427.3	2400	0.563	32.5	3860
20	8.36	483	-423.7	2600	0.592	34.2	4220
25	4.55	263	-414.7				
30	2.7[illegible]	161	-405.7				
35	1.90	110	-396.7				
40	1.41	81.5	-387.7				
45	1.13	65.3	-378.7				
50	0.962	55.6	-369.7				
60	0.774	44.7	-351.7				
70	0.678	39.2	-333.7				
80	0.629	36.3	-315.7				
90	0.606	35.0	-297.7				
100	0.589	34.0	-279.7				
150	0.538	31.1	-189.7				
200	0.510	29.5	- 99.7				
250	0.492	28.4	- 9.7				
273.2	0.486	28.1	32.0				
300	0.479	27.7	80.3				
350	0.470	27.2	170.3				
400	0.461	26.6	260.3				

REMARKS

The recommended values are for well-annealed 99.99% pure rhenium with residual electrical resistivity ρ_0 = *0.0140 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below* about 200 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.50, α' = 4.56 x 10^{-5}, and β = 0.570. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}. ‡Values in parentheses are extrapolated or interpolated.

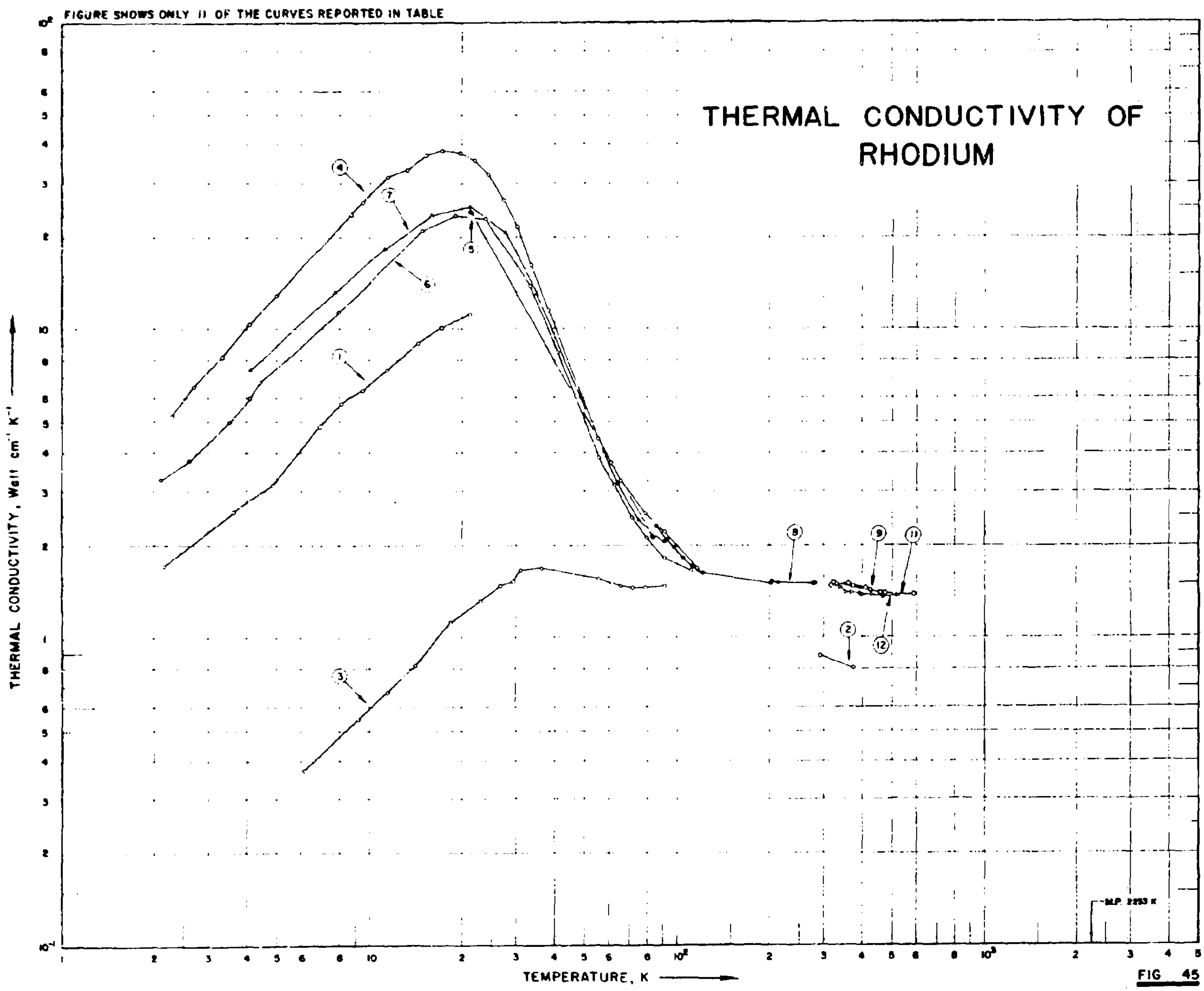


FIGURE SHOWS ONLY 11 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF RHODIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 2233 K

FIG 45

SPECIFICATION TABLE NO. 45 THERMAL CONDUCTIVITY OF RHODIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 45]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	97	L	1952	2.2-21		JM 2357; Rh 1	99.995 pure; 1-2 mm dia x 5 cm long; supplied by Johnson Matthey.
2	8	F	1914	290, 373			Pure; 0.1030 x 0.1030 x 10.0 cm; electrical resistivity reported as 4.811 and 6.211 μohm cm at 0 and 100 C, respectively; specific gravity 12.505.
3	149	L	1957	6.1-91		Rh 1	99.9+ pure; 1.5 mm dia; supplied by Baker Platinum Co.; annealed at 1050 C; residual electrical resistivity 0.44 μohm cm; electrical resistivity ratio $\rho(295K)/\rho(0K) = 12$.
4	149	L	1957	2.3-116		JM 8208; Rh 2	99.997+ Rh, 0.002 Fe, and 0.0005 Cu; 1.5 mm dia; supplied by Johnson Matthey; annealed at 1300 C; ideal electrical resistivity reported as 0.00075, 0.0022, 0.0124, 0.048, 0.107, 0.42, 0.87, 1.91, 2.93, 4.33, 4.78, and 5.8 μohm cm at 15, 20, 30, 40, 50, 75, 100, 150, 200, 273, 295, and 350 K, respectively; residual electrical resistivity 0.0084 μohm cm; electrical resistivity ratio $\rho(295\ K)/\rho(0\ K) = 570$.
5	57	L	1927	21, 83			Pure; supplied by Heraeus; rolled into square wire; annealed in vacuum at 1030 C for 10 min; electrical resistivity reported as 0.01635, 0.595, and 4.58 μohm cm at 21.2, 83.2, and 273.2 K, respectively.
6	253	L	1959	2.1-111		1	Specimen 7.5 x 0.15 x 0.15 cm; made from the specimen used by Gruneisen and Goens, 1927; electrical resistivity reported as 0.0155, 0.0160, 0.0167, 0.0188, 0.0318, 0.0581, 0.170, 0.380, 0.524, 0.751, 1.178, and 5.043 μohm cm at 4.2, 14.3, 18.7, 23.2, 32.9, 40.8, 54.7, 70.1, 78.8, 90.2, 110.6, and 292.3 K, respectively.
7	253	L	1959	4.1-90		2	Same source as the above specimen; dimensions 3.4 x 0.15 x 0.15 cm; annealed in vacuum at 1400 C for 5 hrs and cooled slowly; residual electrical resistivity 0.0148 μohm cm.
8	411	L	1955	86-282			0.03-0.1 Ir, 0.005 Fe, 0.002-0.005 Ag, and 0.001-0.003 Pd; 5 cm long, 0.349 cm dia; supplied by Johnson Matthey Co.; annealed in vacuum at 1336 C; density 12.45 g cm^{-3}; electrical resistivity reported as 0.63, 0.765, 0.86, 1.02, 1.16, 1.265, 1.34, 2.95, 2.99, 3.155, 4.44, and 4.51 μohm cm at 85.8, 92.4, 97.1, 104.9, 112.2, 117.6, 121.6, 202.6, 204.8, 213.8, 277.8, and 281.6 K, respectively.
9	665	C	1962	323-458			The above specimen measured by comparative method using Armco iron as comparative material; residual electrical resistivity 0.024 μohm cm; electrical resistivity ratio $\rho(273K)/\rho_0 = 182$.
10	249	L	1967	84-282		Rh 1	0.03-0.1 Ir, 0.005 Fe, 0.002-0.005 Ag, and 0.001-0.003 Pd; specimen 0.348 cm in dia and 5 cm long supplied by Johnson Matthey Co.; annealed at 1610 K; density 12.44 g cm^{-3}; electrical resistivity reported as 0.92, 2.9, 4.90, 6.95, and 9.15 μohm cm at 100, 200, 300, 400, and 500 K, respectively; electrical resistivity ratio $\rho(273K)/\rho(4.2K) = 180$.
11	249	C	1967	318-591		Rh 1	The above specimen measured by comparative method using Armco iron as comparative material.
12	249	C	1967	310-521		Rh 2	0.001 Fe, 0.0002 Ag, 0.0001 Cu, and 0.0001 Pd; specimen 0.6 cm in dia, 6 cm long; supplied by Johnson Matthey and Co.; density 12.22 g cm^{-3}; electrical resistivity reported as 0.9, 2.95, 4.95, 7.05, and 9.22 μohm cm at 100, 200, 300, 400, and 500 K, respectively; electrical resistivity ratio $\rho(273K)/\rho(4.2K) = 233$.

DATA TABLE NO. 45 THERMAL CONDUCTIVITY OF RHODIUM

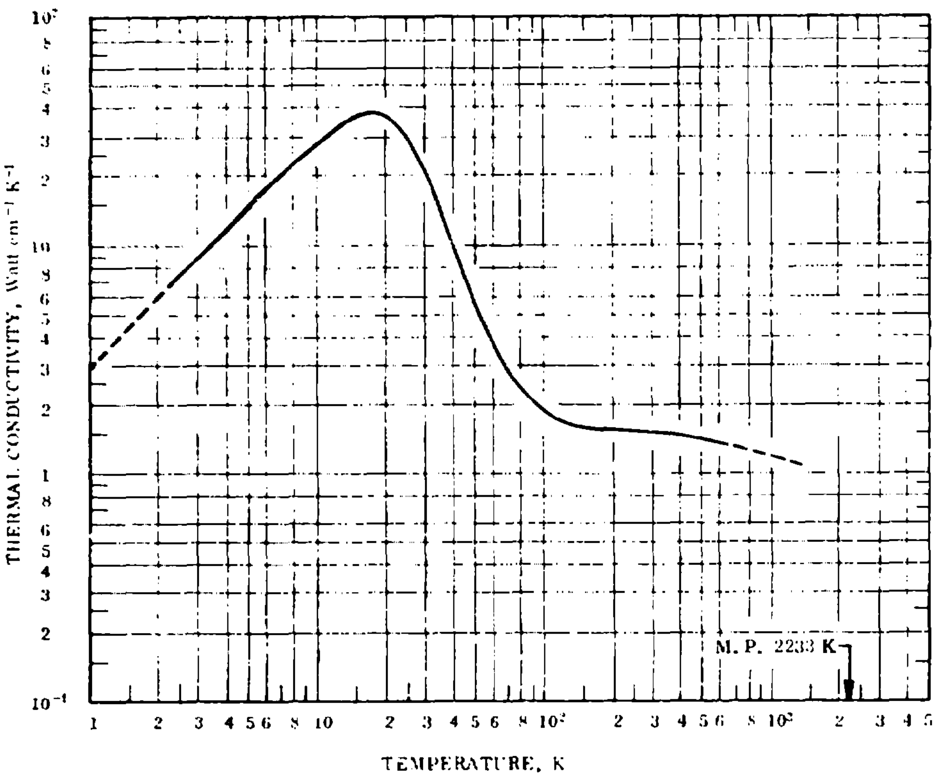
(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k	T	k	T	k	T	k
CURVE 1		**CURVE 4 (cont.)**		**CURVE 6 (cont.)**		**CURVE 10***		**CURVE 12 (cont.)**	
2.15	1.720	8.67	23.661	90.8	1.82	84.3	2.11	389.1	1.403*
3.16	2.581	9.44	25.893	111.2	1.66	85.4	2.06	395.8	1.395
4.82	3.140	11.48	31.696			92.3	2.01	402.1	1.38
6.88	4.860	13.27	33.482	**CURVE 7**		92.8	1.96	427.7	1.38*
8.05	5.740	15.30	37.054			94.1	1.98	432.4	1.378
9.46	6.366	17.09	38.244	4.1	7.43	97.7	1.855	466.1	1.357
11.35	7.441	19.64	37.649	7.7	13.21	105.3	1.755	514.1	1.32*
14.37	9.632	21.94	35.714	11.2	18.09	112.9	1.70	520.9	1.37
17.12	10.150	24.23	32.292	15.9	23.37	118.5	1.69		
21.07	11.230	27.30	26.488	21.2	24.79	122.3	1.66		
		30.10	21.726	27.6	20.61	202.6	1.54		
CURVE 2		33.40	16.220	34.9	13.03	204.9	1.545		
		38.00	11.584	63.6	3.20	213.8	1.535		
290.2	0.879	55.10	4.431	74.8	2.41	277.7	1.53		
373.2	0.803	69.70	3.713	90.3	2.06	277.9	1.55		
		65.30	3.267			281.0	1.535		
CURVE 3		78.30	2.550	**CURVE 8**		281.5	1.52		
		90.80	2.228						
6.12	0.371	115.60	1.683	85.8	2.31	**CURVE 11**			
8.18	0.545			92.4	2.10				
11.43	0.668	**CURVE 5**		97.1	1.98	317.5	1.48		
14.03	0.817			104.9	1.82	322.8	1.51*		
18.37	1.114	21.20	23.800	112.2	1.71	324.6	1.52		
22.96	1.312	83.20	2.150	117.6	1.67	330.1	1.49		
26.53	1.485			121.6	1.63	331.1	1.485*		
29.34	1.535	**CURVE 6**		202.6	1.51	340.6	1.51*		
30.87	1.658			204.8	1.53	363.6	1.49		
36.22	1.683	2.1	3.27	213.8	1.52	370.3	1.47*		
55.36	1.559	2.6	3.77	277.8	1.51	414.6	1.45		
61.22	1.510	3.5	5.00	281.6	1.51	452.5	1.405*		
65.05	1.485	4.1	5.96			475.1	1.39		
71.43	1.460	4.4	6.73	**CURVE 9**		591.2	1.385		
78.80	1.460	7.9	11.28						
30.80	1.485	14.8	20.99	323.2	1.52	**CURVE 12**			
		19.0	23.38	373.2	1.47				
CURVE 4		23.7	22.60	423.2	1.43	310.0	1.485*		
		33.2	13.92	458.2	1.40	316.1	1.47		
2.27	5.272	40.9	8.43			330.0	1.453*		
2.68	6.559	55.5	3.85			348.6	1.45*		
3.32	8.243	62.2	3.15			355.9	1.41		
4.08	10.470	71.0	2.47			360.7	1.453		
4.98	13.000	79.5	2.12			370.8	1.41		

*Not shown on plot

FIGURE AND TABLE NO. 45R RECOMMENDED THERMAL CONDUCTIVITY OF RHODIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	1.40	80.9	440.3
1	(2.91)‡	(168)	-457.9	600	(1.36)	(78.6)	620.3
2	(5.81)	(336)	-456.1	700	(1.31)	(75.7)	800.3
3	8.72	504	-454.3	800	(1.27)	(73.4)	980.3
4	11.6	670	-452.5	900	(1.24)	(71.6)	1160
5	14.5	838	-450.7	1000	(1.21)	(69.9)	1340
6	17.3	1000	-448.9	1100	(1.18)	(68.2)	1520
7	20.1	1160	-447.1	1200	(1.15)	(66.4)	1700
8	22.8	1320	-445.3	1300	(1.13)	(65.3)	1880
9	25.4	1470	-443.5	1400	(1.11)	(64.1)	2060
10	27.8	1610	-441.7				
11	30.0	1730	-439.9				
12	32.0	1850	-438.1				
13	33.7	1950	-436.3				
14	35.1	2030	-434.5				
15	36.1	2090	-432.7				
16	36.9	2130	-430.9				
18	37.2	2150	-427.3				
20	36.4	2100	-423.7				
25	30.7	1770	-414.7				
30	21.6	1250	-405.7				
35	14.5	838	-396.7				
40	10.2	589	-387.7				
45	7.47	432	-378.7				
50	5.70	329	-369.7				
60	3.78	218	-351.7				
70	2.89	167	-333.7				
80	2.38	138	-315.7				
90	2.06	119	-297.7				
100	1.86	107	-279.7				
150	1.58	91.3	-189.7				
200	1.54	89.0	- 99.7				
250	1.52	87.8	- 9.7				
273.2	1.51	87.2	32.0				
300	1.50	86.7	80.3				
350	1.48	85.5	170.3				
400	1.46	84.4	260.3				

REMARKS

The recommended values are for well-annealed 99.997% pure rhodium with residual electrical resistivity ρ_0 = 0.00840 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.70, α' = 3.16×10^{-5}, and β = 0.344. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures.

* T_1 in K, k_1 in Watt $cm^{-1} K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$.

‡ Values in parentheses are extrapolated or estimated.

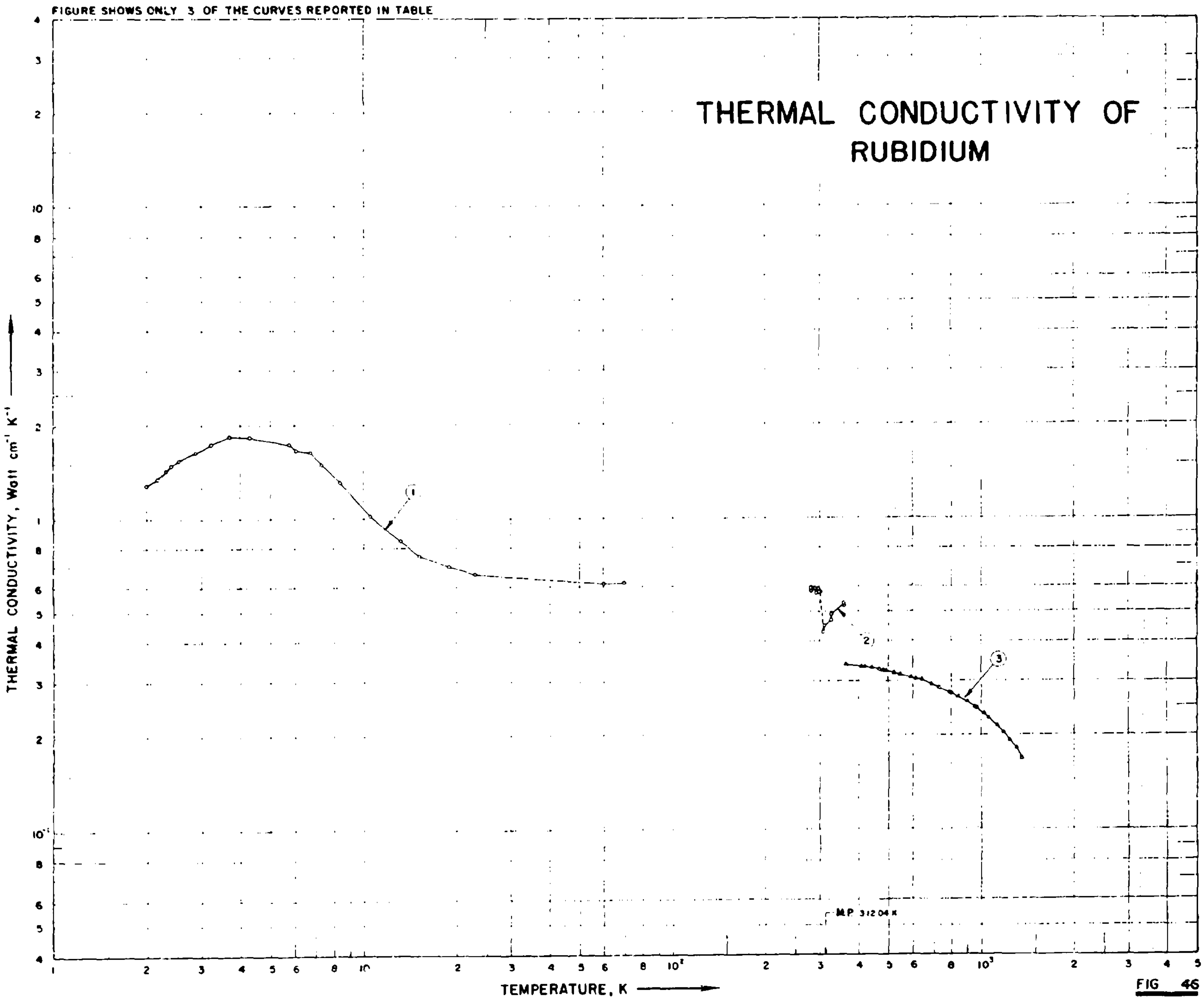


FIGURE SHOWS ONLY 3 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF RUBIDIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 312.04 K
1
2
3

FIG 46

SPECIFICATION TABLE NO. 46 THERMAL CONDUCTIVITY OF RUBIDIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 46]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	92	L	1956	2.0-70		Rb 1	High purity; 1.65 mm dia; supplied by A.D. MacKay (New York); electrical resistivity ratio $\rho(295\ K)/\rho(0\ K)$ = 380 (using electrical resistivity ρ(295 K) = 14.6 μ ohm cm).
2	385	L	1940	281-361			Supplied by Ukraine Chemical Institute of Odessa; specific resistance 35% greater than that of pure Rb; M.P. 8 C lower than that of pure Rb.
3	655	-	1964	367-1370			99.5 pure; electrical resistivity measured in argon and reported as 11.28, 12.51, 26.55, 30.12, 30.88, 32.82, 35.39, 35.90, 40.56, 42.70, 47.03, 47.48, 54.49, 58.01, 60.70, 69.82, 77.41, 85.30, 86.05, 96.59, 105.82, 117.59, 129.96, 144.17, 144.27, 159.55, 174.96, 196.97, and 197.36 μ ohm cm at 273.2, 302.6, 366.5, 414.3, 418.7, 442.1, 469.3, 482.6, 524.3, 547.1, 592.1, 595.4, 643.7, 691.5, 734.8, 790.9, 848.7, 901.5, 903.7, 969.3, 1020.9, 1076.5, 1135.4, 1190.9, 1195.4, 1249.8, 1303.7, 1367.6, and 1369.8 K, respectively; thermal conductivity values calculated from electrical resistivity data using theoretical Lorenz number $2.45 \times 10^{-8}\ V^2K^{-2}$.
4	882	-	1967	822-969			Specimen in vapor state; measuring method based on the study of laminar flow in a long tube with a constant wall temperature, combined with the heat exchange theory; data calculated from the measured temperature and flow rate and the specific heat of the vapor which was obtained from Achener, P.Y., et al., (USAEC Rept. AGN-8192, 1967).
5	881		1962	944-1121			Vapor Rubidium specimen; atomic dia σ = 12.7 Å; thermal conductivity data estimated.
6	756	-	1962	312-1025			0.32 Cs, 0.06 K, and 0.05 Na; composition after testing, 0.39 Cs, 0.13 Na, 0.11 K, 0.03 Ca, 0.008 Fe, 0.005 O, 0.002 Ni, < 0.001 each of Cr and Li; molten specimen contained in a type 347 stainless-steel tube; supplied by American Potash and Chemical Corp.; electrical resistivity reported as 13.85, 14.67, 22.84, 22.93, 23.35, 25.96, 31.62, 37.06, 42.30, 46.59, 46.61, 52.45, 58.01, 59.37, 64.61, 71.48, 72.49, 81.06, 91.29, 99.05, and 109.31 μ ohm cm at 25.6, 37.5, 39.2, 41.7, 46.4, 91.7, 146.7, 204.2, 260.3, 308.3, 309.4, 361.7, 412.5, 426.1, 463.1, 520.3, 528.9, 581.7, 650.1, 697.2, and 751.7 C, respectively; thermal conductivity values calculated from measured electrical resistivity data and the theoretical Lorenz number $2.45 \times 10^{-8}\ V^2K^{-2}$.

DATA TABLE NO. 46 THERMAL CONDUCTIVITY OF RUBIDIUM

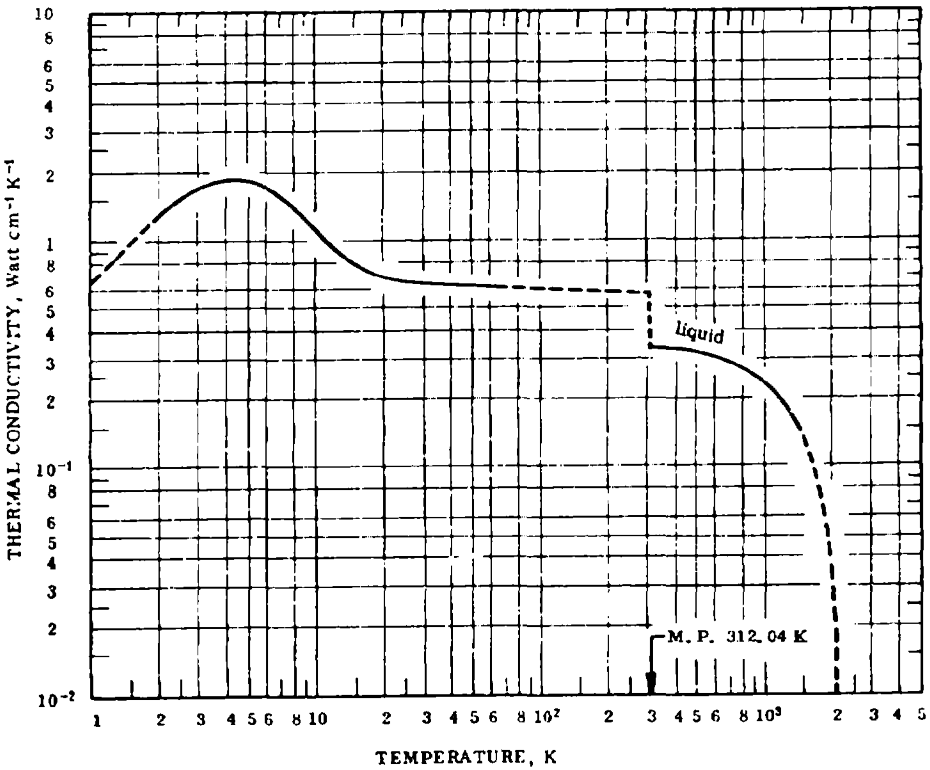
(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k	T	k
CURVE 1		CURVE 3		CURVE 4*	
2.00	1.272	366.5	0.3387	822.1	0.0000486
2.19	1.335	414.3	0.3327	874.3	0.0000537
2.32	1.422	418.7	0.3321*	969.3	0.0000625
2.41	1.480	426.5	0.3311		
2.55	1.543	442.1	0.3291	CURVE 5*	
2.88	1.646	469.3	0.3254		
3.25	1.744	482.6	0.3236	944	0.0000116
3.71	1.848	492.1	0.3223	1000	0.0000113
4.32	1.836	524.3	0.3179	1060	0.0000114
5.80	1.744	528.7	0.3172*	1121	0.0000111
6.12	1.670	547.1	0.3146		
6.77	1.640	592.1	0.3081	CURVE 6*	
7.39	1.496	595.4	0.3076*		
8.45	1.300	618.2	0.3042	312.4	0.335
10.60	1.024	643.7	0.3003	419.9	0.325
13.30	0.846	691.5	0.2929	533.5	0.309
15.31	0.753	733.7	0.2861	634.9	0.297
19.02	0.700	734.8	0.2859*	699.3	0.289
23.20	0.661	790.9	0.2767	854.9	0.258
60.0	0.618	803.2	0.2747	923.3	0.248
70.0	0.618	840.9	0.2683	1025	0.230
		848.7	0.2670*		
CURVE 2		901.5	0.2578		
		903.7	0.2574*		
281.2	0.59	957.1	0.2480		
282.2	0.58	969.3	0.2458		
290.7	0.59	1020.9	0.2363		
293.2	0.57	1068.7	0.2275		
296.7	0.59	1076.5	0.2260*		
298.7	0.575	1135.4	0.2149		
300.7	0.575	1190.4	0.2043		
302.2	0.575	1190.9	0.2042*		
309.2	0.42	1195.4	0.2033*		
310.5	0.45	1249.8	0.1927		
327.8	0.47	1303.7	0.1820		
328.2	0.49	1307.1	0.1814*		
360.2	0.53	1367.6	0.1692		
361.2	0.52	1369.8	0.1688*		

*Not shown on plot

FIGURE AND TABLE NO. 46R RECOMMENDED THERMAL CONDUCTIVITY OF RUBIDIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.663)‡	(38.3)	-457.9
2	1.27	73.4	-456.1
3	1.71	98.8	-454.3
4	1.91	106	-452.5
5	1.88	109	-450.7
6	1.73	100	-448.9
7	1.56	90.1	-447.1
8	1.38	79.7	-445.3
9	1.22	70.5	-443.5
10	1.09	63.0	-441.7
11	0.991	57.3	-439.9
12	0.919	53.1	-438.1
13	0.859	49.6	-436.3
14	0.810	46.8	-434.5
15	0.772	44.6	-432.7
16	0.746	43.1	-430.9
18	0.710	41.0	-427.3
20	0.685	39.6	-423.7
25	0.657	38.0	-414.7
30	0.647	37.4	-405.7
35	0.640	37.0	-396.7
40	0.635	36.7	-387.7
45	0.630	36.4	-378.7
50	0.627	36.2	-369.7
60	0.620	35.8	-351.7
70	0.615	35.5	-333.7
80	(0.611)	(35.3)	-315.7
90	(0.607)	(35.1)	-297.7
100	(0.603)	(34.8)	-279.7
150	(0.594)	(34.3)	-189.7
200	(0.589)	(34.0)	- 99.7
250	(0.586)	(33.9)	- 9.7
273.2	(0.583)	(33.7)	32.0
300	0.582	33.6	80.3
312.04	0.581	33.6	102.0

T_1	k_1	k_2	T_2
	In Liquid State		
312.04	0.339	19.6	102.0
350	0.336	19.4	170.3
400	0.331	19.1	260.3
500	0.318	18.4	440.3
600	0.304	17.6	620.3
700	0.289	16.7	800.3
800	0.273	15.8	980.3
900	0.255	14.7	1160
1000	0.237	13.7	1340
1100	0.219	12.7	1520
1200	0.200	11.6	1700
1300	0.180	10.4	1880
1400	(0.159)	(9.19)	2060
1500	(0.139)	(8.03)	2240
1600	(0.118)	(6.82)	2420
1700	(0.096)	(5.55)	2600
1800	(0.074)	(4.28)	2780
1900	(0.052)	(3.00)	2960
2000	(0.027)	(1.56)	3140
2100	(~0)	(~0)	3320

REMARKS

The recommended values are for high-purity rubidium with residual electrical resistivity $\rho_0 = 0.0368\ \mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 70 K). The values below 1.5 T_m are calculated to fit the experimental data by using $n = 2.00$, $\alpha' = 0.0093$, and $\beta = 1.50$. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated, interpolated, or estimated.

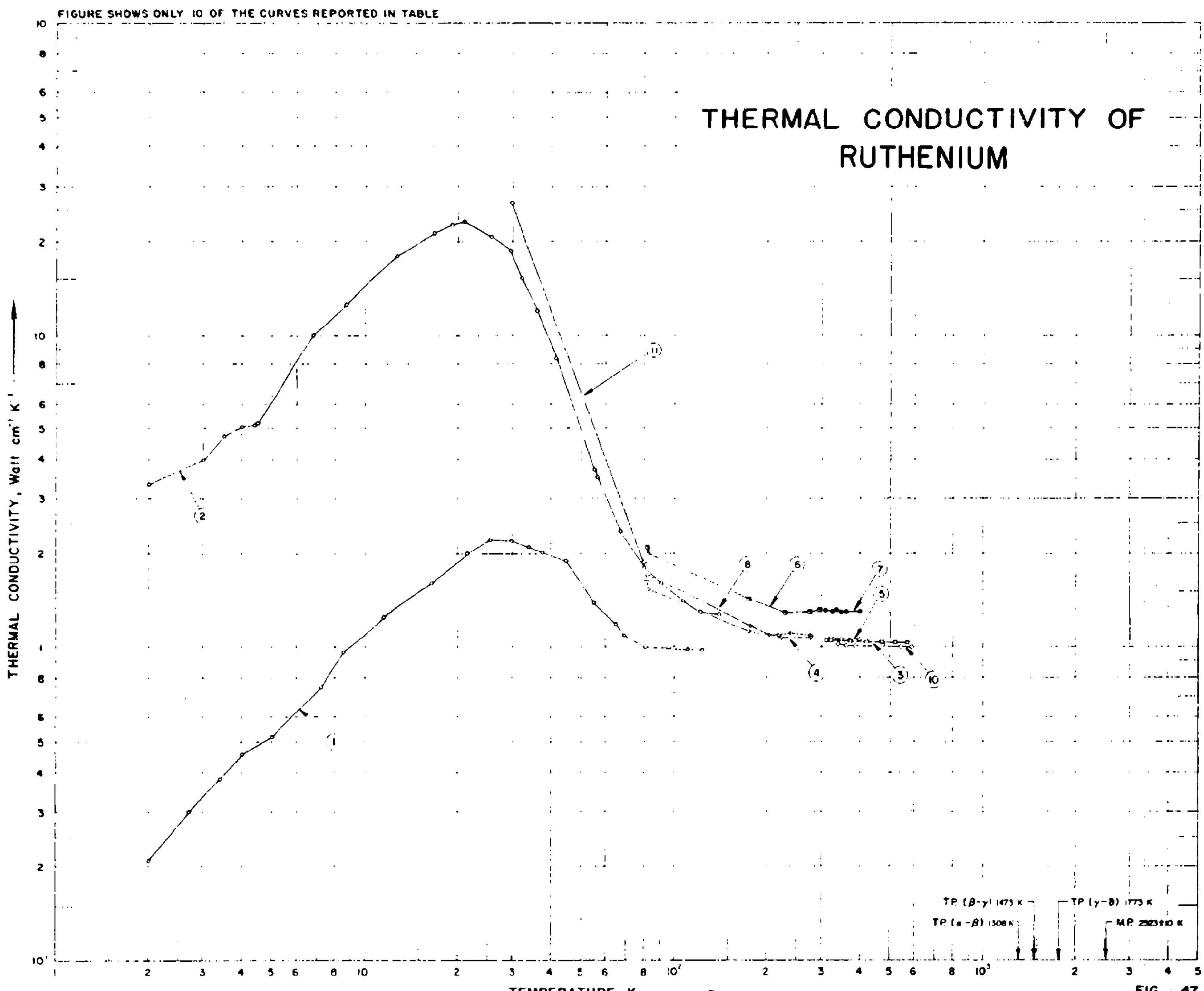


FIGURE SHOWS ONLY 10 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF RUTHENIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
TP (β-γ) 1473 K
TP (α-β) 1308 K
TP (γ-δ) 1773 K
M.P. 2523±10 K

FIG 47

SPECIFICATION TABLE NO. 47 THERMAL CONDUCTIVITY OF RUTHENIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 47]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	384	L	1958	2.0-124	11	Ru 2	99.995⁺ pure; polycrystalline; grain size 1 mm; approx 6 mm in dia and 7 cm long; Ru powder supplied by Baker Platinum Co.; specimen prepared by arc-melting pressed pellets of powder in an inert atmosphere; specific gravity 12.0 at 22 C; ideal electrical resistivity reported as 0.034, 0.067, 0.19, 0.38, 1.07, 1.90, 3.61, 5.26, 6.85, 7.60, and 8.27 μohm cm at 25, 30, 40, 50, 75, 100, 150, 200, 250, 273, and 295 K, respectively; residual electrical resistivity 0.235 μohm cm; $\rho(295K)/\rho_0 = 36.1$; Lorenz function 2.40×10^{-8} V^2 K^{-2} at 0 K.
2	384	L	1958	2.0-140	9	Ru 3	Similar to the above specimen except dimensions approx 5 mm in dia and 6 cm long; specific gravity 12.25 at 22 C; ideal electrical resistivity reported as 0.005, 0.010, 0.037, 0.11, 0.54, 1.25, 2.80, 4.38, 5.76, 6.69, and 7.37 μohm cm at 25, 30, 40, 50, 75, 100, 150, 200, 250, 273, and 295 K, respectively; residual electrical resistivity 0.0158 μohm cm; $\rho(295K)/\rho_0 = 467$; Lorenz function 2.46×10^{-8} V^2 K^{-2} at 0 K.
3	665	C	1962	313-573	2		0.1 Fe, 0.03 Rh, 0.002 Pt, 0.001 Cu, 0.001 Ni, and 0.0005 Pd; 2.5 cm long, 0.660 cm in dia; supplied by Johnson Matthey Co.; argon-arc melted and ground; density 12.36 g cm^{-3}; electrical resistivity reported as 0.566 and 7.13 μohm cm at liquid helium and ice temp, respectively; Armco iron used as comparative material.
4	249	L	1967	83-280		a	99.96 Ru (by difference), 0.03 Os, 0.006 Fe, 0.003 Ni, and 0.001 Pd; single crystal; specimen 0.65 cm in dia, 10 cm long; axis of specimen perpendicular to prism axis of crystal; supplied by the International Nickel Co. Ltd. (Mond); as received; density 12.38 g cm^{-3}; electrical resistivity reported as 1.42, 4.58, 7.62, 10.5, and 13.3 μohm cm at 100, 200, 300, 400, and 500 K, respectively; electrical resistivity ratio $\rho(273K)/\rho(4.2K) = 94$.
5	249	C	1967	322-476		a	The above specimen measured by comparative method using Armco iron as comparative material.
6	249	L	1967	83-298		b	Same purity and supplier as the above specimen; 0.68 cm in dia, 10 cm long; single crystal; axis of the specimen parallel to prism axis of crystal; as received; density 12.38 g cm^{-3}; electrical resistivity reported as 1.07, 3.46, 5.82, 8.15, and 10.4 μohm cm at 100, 200, 300, 400, and 500 K, respectively; electrical resistivity ratio $\rho(273K)/\rho(4.2K) = 76.5$.
7	249	C	1967	310-404		b	The above specimen measured by comparative method using Armco iron as comparative material.
8	249	L	1967	83-277		c	0.03 Os, 0.006 Fe, 0.003 Ni, and 0.001 Pd; polycrystalline bar 0.635 cm in dia, 10 cm long; supplied by the International Nickel Co.; pressed at 20 ton $in.^{-2}$; sintered in vacuo at 1920 K and hot forged; as received; density 12.24 g cm^{-3}; electrical resistivity reported as 1.30, 4.38, 7.43, 10.4, and 13.2 μohm cm at 100, 200, 300, 400, and 500 K, respectively; electrical resistivity ratio $\rho(273K)/\rho(4.2K) = 388$.
9	249	C	1967	365-510		c	The above specimen measured by comparative method using Armco iron as comparative material.

SPECIFICATION TABLE NO. 47 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
10	249	C	1967	341-592		d	0.03 Rh, 0.01 Fe, 0.002 Pt, 0.001 Cu, 0.001 Ni, and 0.0005 Pd; polycrystalline; 0.66 cm in dia, 2.5 cm long; supplied by Johnson Matthey and Co.; arc-melted and ground; as received; density 12.36 g cm^{-3}; electrical resistivity reported as 1.83, 4.83, 7.85, 10.74, and 13.4 μohm cm at 100, 200, 300, 400, and 500 K, respectively; Armco iron used as comparative material.

DATA TABLE NO. 47 THERMAL CONDUCTIVITY OF RUTHENIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

CURVE 1

T	k
2.0	0.21
2.7	0.30
3.4	0.38
4.0	0.46
5.0	0.52
7.2	0.75
8.5	0.96
11.5	1.26
16.5	1.6
21.5	2.0
25.5	2.21
29.7	2.2
34.0	2.1
37.5	2.02
44.7	1.9
55.0	1.38
64.8	1.2
69.0	1.1
81.0	1.0
111	0.98
124	0.98

CURVE 2

T	k
2.0	3.33
3.0	4.0
3.5	4.75
4.0	5.08
4.4	5.15
4.5	5.22
6.8	10.05
8.7	12.5
12.7	18.0
16.8	21.3
19.2	22.5
21.0	23.0
25.6	20.8
29.5	18.8
32.1	15.08
36.0	12.0
41.9	8.34

CURVE 2 (cont.)

T	k
55.2	3.7
56.5	3.5
67.0	2.35
80.0	1.80
90.8	1.60
107.6	1.40
122.0	1.39
140.0	1.28

CURVE 3

T	k
313	1.060
323	1.060
373	1.050
423	1.045
473	1.045
523	1.040
573	1.035

CURVE 4

T	k
82.9	1.62
82.1	1.58
83.1	1.53
175.3	1.14
177.1	1.14
225.9	1.08
225.1	1.06
277.9	1.08
280.1	1.09

CURVE 5

T	k
322.1	1.07
331.3	1.065
336.9	1.07
349.7	1.065
355.1	1.055
364.3	1.07
375.8	1.055
399.9	1.065
412.1	1.05
476.1	1.03

CURVE 6

T	k
82.6	2.09
82.1	2.04
83.1	2.01
175.3	1.42
177.1	1.41
230.6	1.29
233.1	1.28
276.6	1.30
279.1	1.31
297.6	1.32

CURVE 7

T	k
310.1	1.32
327.1	1.31
338.1	1.325
350.1	1.305
356.1	1.31
362.1	1.305
366.1	1.30
404.1	1.305

CURVE 8

T	k
82.6	1.70
82.1	1.67
83.1	1.66
177.8	1.18
205.1	1.11
219.6	1.11
221.6	1.09
227.6	1.085
227.6	1.11
239.5	1.13
277.4	1.10

CURVE 9

T	k
365.1	1.05
385.1	1.06
389.1	1.04
395.1	1.05
441.1	1.04

CURVE 9 (cont.)

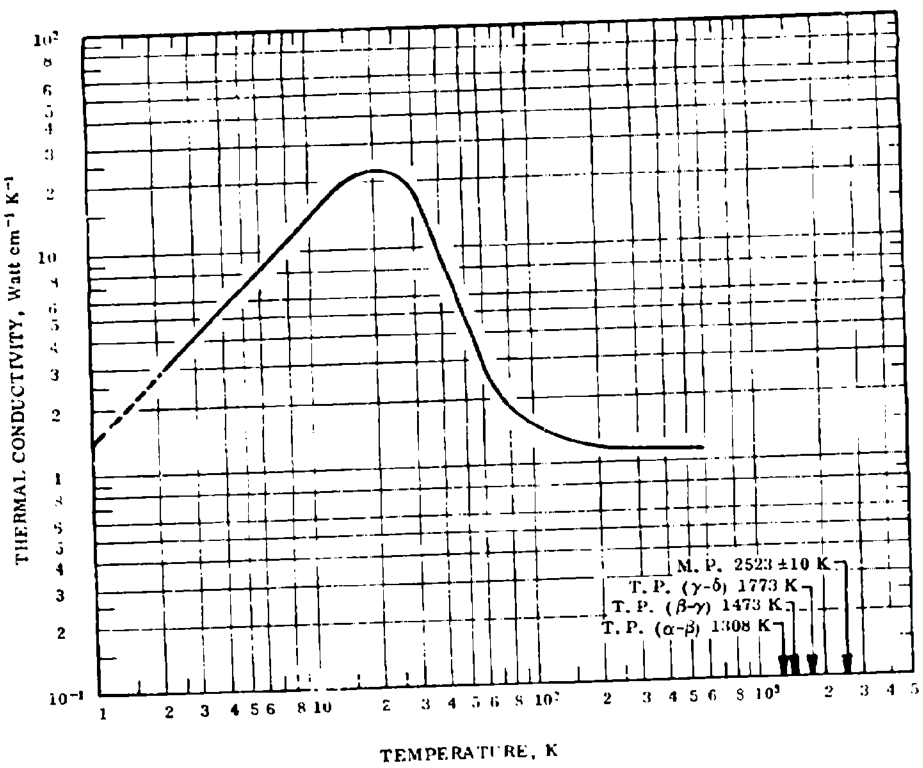
T	k
470.1	1.01
510.1	1.03

CURVE 10

T	k
341.1	1.03
346.1	1.025
362.1	1.025
388.6	1.02
396.1	1.02
456.1	1.015
544.1	1.015
591.6	1.01

*Not shown on plot

FIGURE AND TABLE NO. 47R RECOMMENDED THERMAL CONDUCTIVITY OF RUTHENIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(1.42)‡	(82.0)	-457.9
2	2.84	164	-456.1
3	4.26	246	-454.3
4	5.67	328	-452.5
5	7.09	410	-450.7
6	8.50	491	-448.9
7	9.90	572	-447.1
8	11.3	65[illegible]	-445.3
9	12.7	734	-443.5
10	14.0	809	-441.7
11	15.3	884	-439.9
12	16.5	953	-438.1
13	17.7	1020	-436.3
14	18.8	1090	-434.5
15	19.8	1140	-432.7
16	20.6	1190	-430.9
18	22.0	1270	-427.3
20	22.7	1310	-423.7
25	21.8	1260	-414.7
30	17.7	1020	-405.7
35	13.1	757	-396.7
40	9.33	539	-387.7
45	6.72	388	-378.7
50	4.95	286	-369.7
60	3.04	176	-351.7
70	2.22	129	-333.7
80	1.84	106	-315.7
90	1.65	95.3	-297.7
100	1.54	89.0	-279.7
150	1.28	74.0	-189.7
200	1.18	68.2	- 99.7
250	1.17	67.6	- 9.7
273.2	1.17	67.6	32.0
300	1.17	67.6	80.3
350	1.16	67.0	170.3
400	1.15	66.4	260.3
500	1.13	65.3	440.3
600	1.11	64.1	620.3

REMARKS

The recommended values are for well-annealed 99.995+% pure ruthenium with residual electrical resistivity ρ_0 = 0.00860 μΩ cm (characterization by ρ_0 becomes important at temperatures below about 250 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 3.10, a = 2.5, m = 5.60, α' = 3.91 x 10^{10}, and β = 0.705. The recommended values are thought to be accurate to within 4% of the true values near room temperature and 4 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡Values in parentheses are extrapolated.

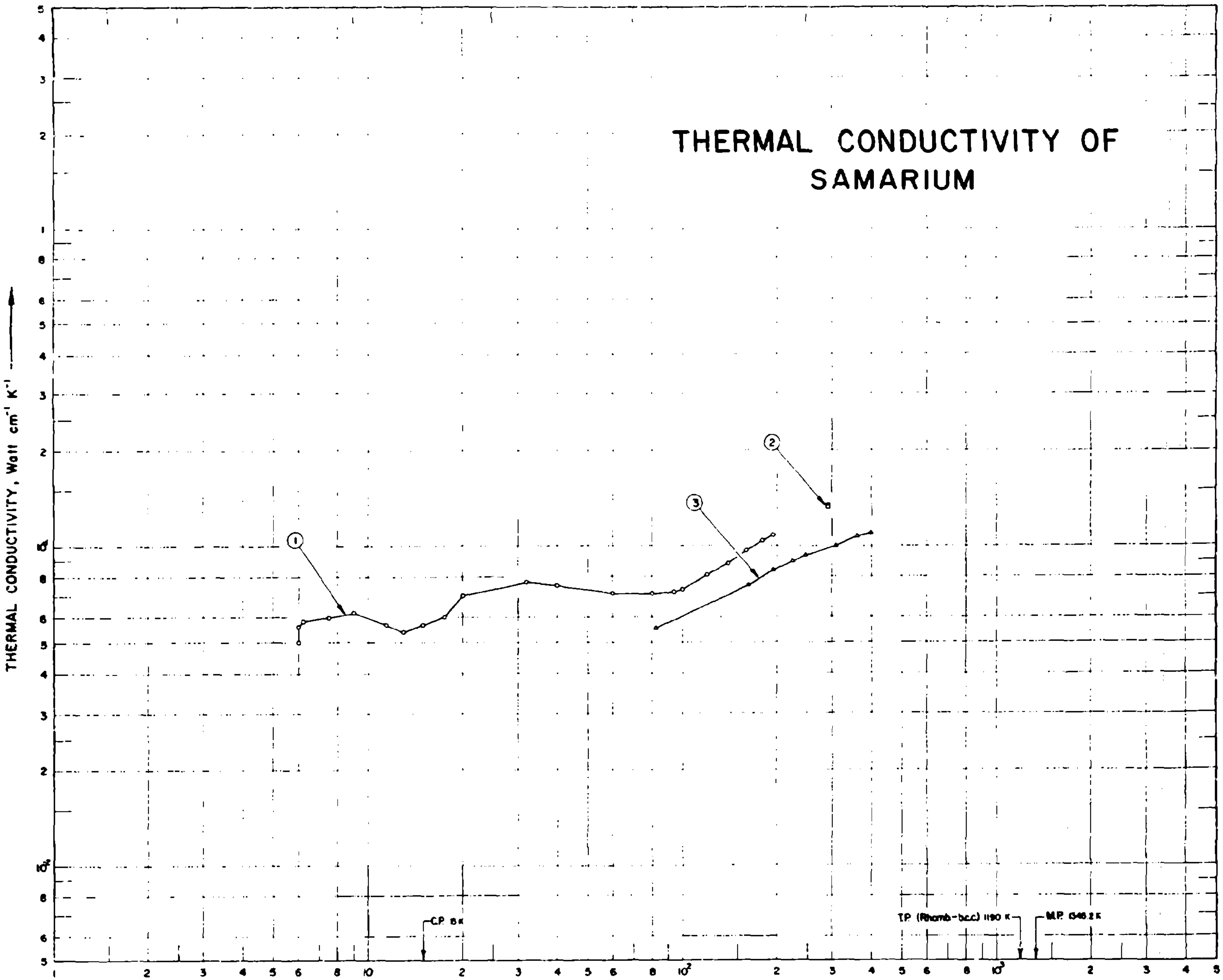

THERMAL CONDUCTIVITY OF SAMARIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
C.P. 15 K
T.P. (Rhomb-b.c.c.) 1190 K
M.P. 1346.2 K
1
2
3

FIG 48

SPECIFICATION TABLE NO. 48 THERMAL CONDUCTIVITY OF SAMARIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 48]

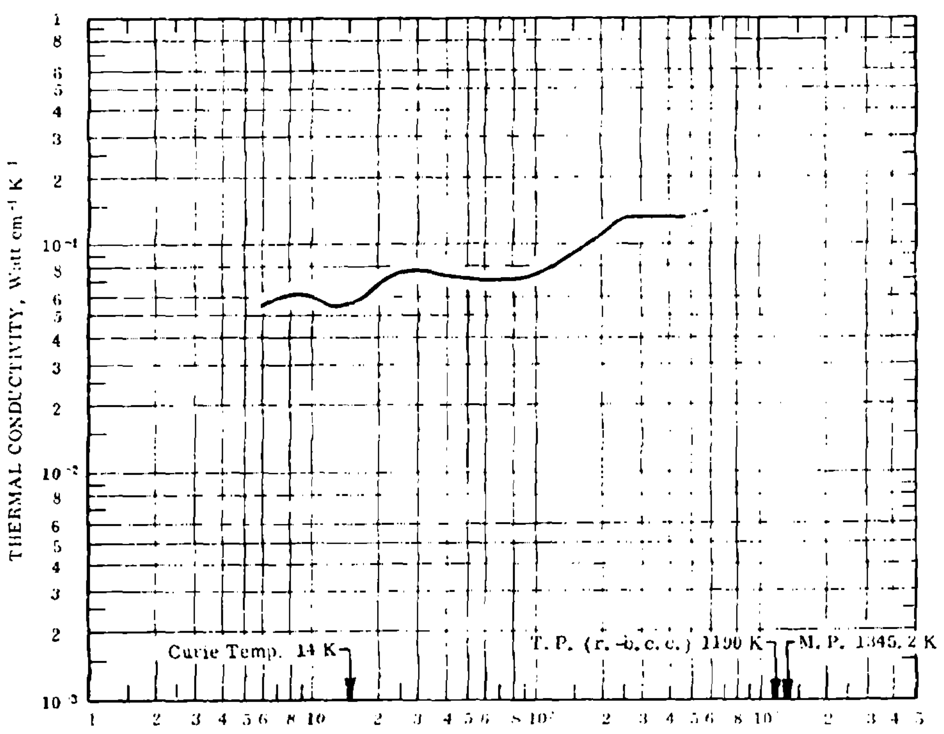
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	812	L	1965	6.0-196			0.05 Eu, 0.02 Ca, 0.01 Gd, 0.01 Mg, and 0.005 Si; polycrystalline; 0.479 cm dia, 6 cm long; Sm supplied by Research Chemicals; arc-melted in 100 torr argon atmosphere and machined; electrical resistivity reported as 6.73, 7.90, 12.1, 15.1, 16.3, 18.2, 28.2, 39.6, 51.3, 61.8, 62.3, 63.0, 64.7, 70.5, 82.5, and 93.4 μohm cm at 4.17, 8.12, 13.8, 16, 20, 40, 60, 80, 100, 105, 110, 120, 160, 240, and 308 K, respectively; data taken from smoothed curve.
2	777	C	1965	291.2	3		High purity; polycrystalline; 0.25 in. in dia, 0.25 in. long; supplied by Johnson Matthey and Co.; electrical resistivity 94 μohm cm at 18 C; measurements made using 2 different thermal comparators. Monel metal used as comparative material.
3	810	L	1964	83-397			Impurities: 0.5 Eu, 0.18 Ca, 0.02 Gd, 0.01 Nd, and 0.01 Y; prepared by briquetting powder under a pressure of ~8000 Kg cm^{-2} and annealing in vacuo (~1 x 10^{-4} mm Hg) for 1-2 hrs at 1600-1800 C; measured in vacuo of ~5 x 10^{-6} mm Hg; data taken from smoothed curve of measurements on several specimens.

DATA TABLE NO. 48 THERMAL CONDUCTIVITY OF SAMARIUM

[Temperature, T, K; Thermal Conductivity, k, Watt cm⁻¹K⁻¹]

T	k
CURVE 1	
6.0	0.050
6.0	0.056
6.25	0.0585
7.5	0.060
9.9	0.062
11.5	0.057
13	0.054
15	0.057
17.5	0.060
20	0.070
32	0.077
40	0.075
60	0.071
80	0.071
94	0.072
100	0.073
120	0.081
140	0.088
160	0.097
180	0.104
196	0.108
CURVE 2	
291.2	0.133
291.2	0.134
CURVE 3	
82.5	0.0552
163	0.0753
195	0.0836
225	0.0895
247	0.0933
308	0.100
360	0.107
397	0.110

FIGURE AND TABLE NO. 48R RECOMMENDED THERMAL CONDUCTIVITY OF SAMARIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
6	0.0555	3.21	-448.9
7	0.0591	3.41	-447.1
8	0.0611	3.53	-445.3
9	0.0618	3.57	-443.5
10	0.0607	3.51	-441.7
11	0.0586	3.39	-439.9
12	0.0557	3.22	-438.1
13	0.0542	3.13	-436.3
14	0.0551	3.18	-434.5
15	0.0566	3.27	-432.7
16	0.0580	3.35	-430.9
17	0.0598	3.46	-429.1
18	0.0623	3.60	-427.3
19	0.0659	3.81	-425.5
20	0.0692	4.00	-423.7
21	0.0703	4.06	-421.9
22	0.0727	4.20	-420.1
23	0.0738	4.26	-418.3
25	0.0754	4.36	-414.7
30	0.0770	4.45	-405.7
35	0.0768	4.44	-396.7
40	0.0754	4.36	-387.7
45	0.0742	4.29	-378.7
50	0.0732	4.23	-369.7
60	0.0714	4.13	-351.7
70	0.0708	4.09	-333.7
80	0.0709	4.10	-315.7
90	0.0714	4.13	-297.7
100	0.0735	4.25	-279.7
150	0.0924	5.34	-189.7
200	0.113	6.53	- 99.7
220	0.123	7.11	- 63.7
250	0.132	7.63	- 9.7
273.2	0.133	7.68	32.0
300	0.133	7.68	80.3
350	0.133	7.68	170.3
400	0.133	7.68	260.3
500	(0.135)‡	(7.80)	440.3
600	(0.141)	(8.15)	620.3

REMARKS

The recommended values are for well-annealed 99.9% pure samarium with residual electrical resistivity ρ_0 = 6.73 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

---

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡Values in parentheses are extrapolated.

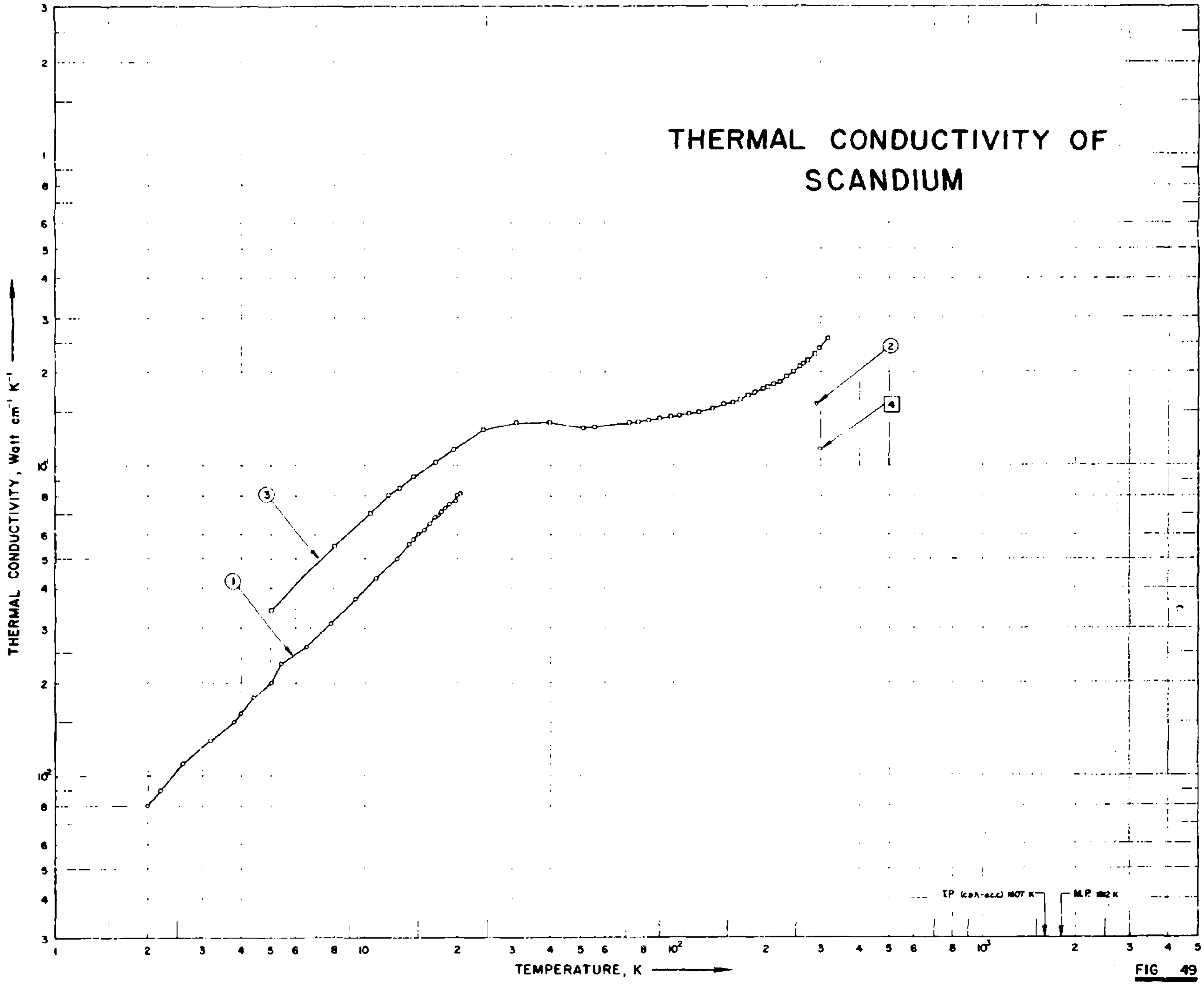

THERMAL CONDUCTIVITY OF
SCANDIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
TP (cph-bcc) 1607 K
M.P. 1812 K
1
2
3
4

FIG 49

SPECIFICATION TABLE NO. 49 THERMAL CONDUCTIVITY OF SCANDIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 49]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	817, 897	L	1965	2.0-21			Approx 99.9 pure; flat specimen 0.25 mm thick; electrical resistivity 71 μohm cm at 293 K; electrical resistivity ratio $\rho(293K)/\rho(4.2K)$ = 9.59; Lorenz number 2.96 x 10^{-8} V^2 K^{-2} at 4.2 K.
2	777	C	1965	291.2	±3.0		High purity; polycrystalline; specimen 0.25 in. in dia and 0.25 in. long; supplied by Johnson Matthey Co.; electrical resistivity 52 μohm cm at 18 C; Monel metal used as comparative material; measurements made using 2 different thermal comparators.
3	818	L	1964	5-316			High purity, traces of Ta, Ca, and Fe; polycrystalline; specimen 0.486 cm in dia and 6.35 cm long; supplied by St. Eloi Corp. electrical resistivity reported as 10.7, 12.0, 18.0, [illegible], 32.8, 40.1, 47.9, 54.8, and 61.8 μohm cm at 6.2, 40, 80, 120, 160, 200, 240, 280, and 320 K, respectively; residual electrical resistivity ~10.6 μohm cm; measured in a vacuum of 6 x 10^{-6} mm Hg.
4	1003	–	1961	298.2			<0.3 Ta, <0.62 Cu, <0.61 Ag, <0.002 Fe, and <0.01 other rare earth metals; melting point 1522 ± 5 C; electrical resistivity reported as 67, 91, 112, 131, 146, 159, 172, 183, 193, 203, 212, and 215 μohm cm at 0, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, and 1360 C, respectively; thermal conductivity value calculated from the measured datum of electrical resistivity and the Lorenz function taken as 2.7 x 10^{-8} V^2 K^{-2}.

DATA TABLE NO. 49 THERMAL CONDUCTIVITY OF SCANDIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
2.0	0.008
2.2	0.009
2.6	0.011
3.2	0.013
3.8	0.015
4.0	0.016
4.4	0.018
5.0	0.020
5.4	0.023
6.5	0.026
7.8	0.031
9.4	0.037
11.0	0.043
12.8	0.050
14.0	0.056
14.5	0.058
15.0	0.060
15.7	0.062
16.4	0.065
17.0	0.068
17.4	0.069
17.8	0.071
18.3	0.073
18.8	0.075
19.7	0.077
20.0	0.080
20.5	0.081

CURVE 2

T	k
291.2	0.155
291.2	0.159

CURVE 3

T	k
5.0	0.0343
8.2	0.055
10.5	0.070
12.0	0.080
13.0	0.085
14.5	0.0920
17.0	0.103

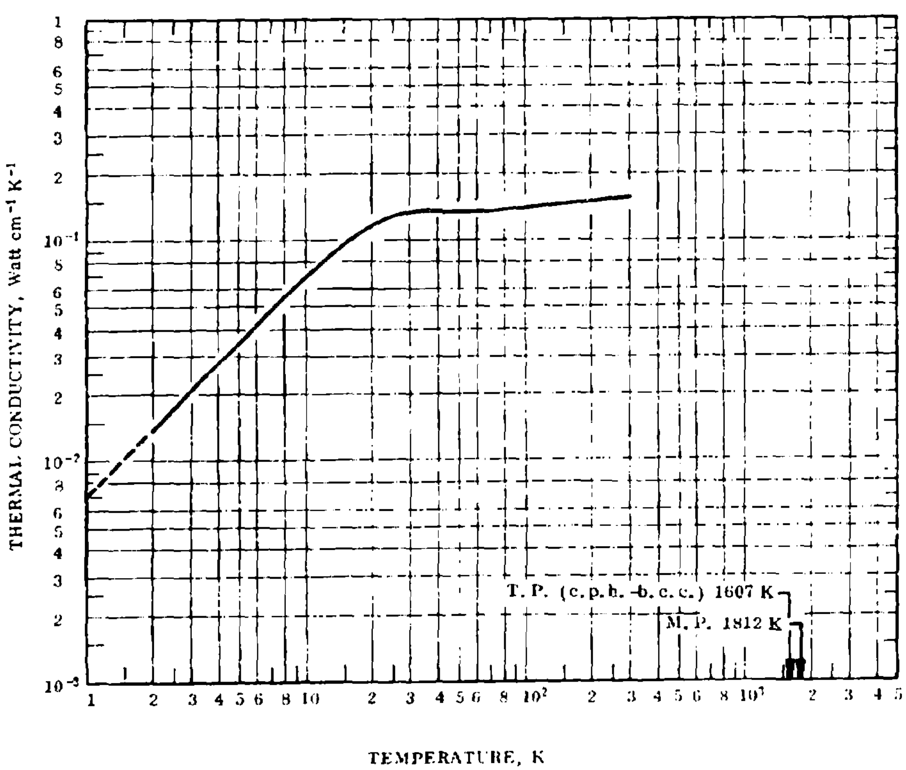
CURVE 3 (cont.)

T	k
19.5	0.113
24.3	0.130
31.0	0.137
39.8	0.137
51.9	0.132
55.5	0.133
72.0	0.137
77.0	0.138
83.0	0.140
90.0	0.142
98.0	0.144
105.0	0.145
112	0.147
121	0.149
134	0.153
146	0.157
156	0.159
165	0.163
175	0.168
184	0.171
196	0.176
201	0.178
211	0.182
221	0.185
232	0.192
245	0.199
258	0.207
264	0.211
273	0.218
287	0.229
298	0.239
316	0.257

CURVE 4

T	k
298.2	0.113

FIGURE AND TABLE NO. 49R RECOMMENDED THERMAL CONDUCTIVITY OF SCANDIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.00706)‡	(0.408)	-457.9
2	0.0140	0.809	-456.1
3	0.0208	1.20	-454.3
4	0.0276	1.59	-452.5
5	0.0344	1.99	-450.7
6	0.0412	2.38	-448.9
7	0.0479	2.77	-447.1
8	0.0545	3.15	-445.3
9	0.0612	3.54	-443.5
10	0.0678	3.92	-441.7
11	0.0738	4.26	-439.9
12	0.0797	4.60	-438.1
13	0.0855	4.94	-436.3
14	0.0910	5.26	-434.5
15	0.0960	5.55	-432.7
16	0.101	5.84	-430.9
18	0.109	6.30	-427.3
20	0.117	6.76	-423.7
25	0.130	7.51	-414.7
30	0.137	7.92	-405.7
35	0.138	7.97	-396.7
40	0.138	7.97	-387.7
45	0.136	7.86	-378.7
50	0.135	7.80	-369.7
60	0.136	7.86	-351.7
70	0.138	7.97	-333.7
80	0.139	8.03	-315.7
90	0.141	8.15	-297.7
100	0.143	8.26	-279.7
150	0.149	8.61	-189.7
200	0.153	8.84	- 99.7
250	0.156	9.01	- 9.7
273.2	0.157	9.07	32.0
300	0.158	9.13	80.3

REMARKS

The recommended values are for well-annealed high-purity scandium with residual electrical resistivity $\rho_0 = 10.6\ \mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 250 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

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*T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡Values in parentheses are extrapolated.

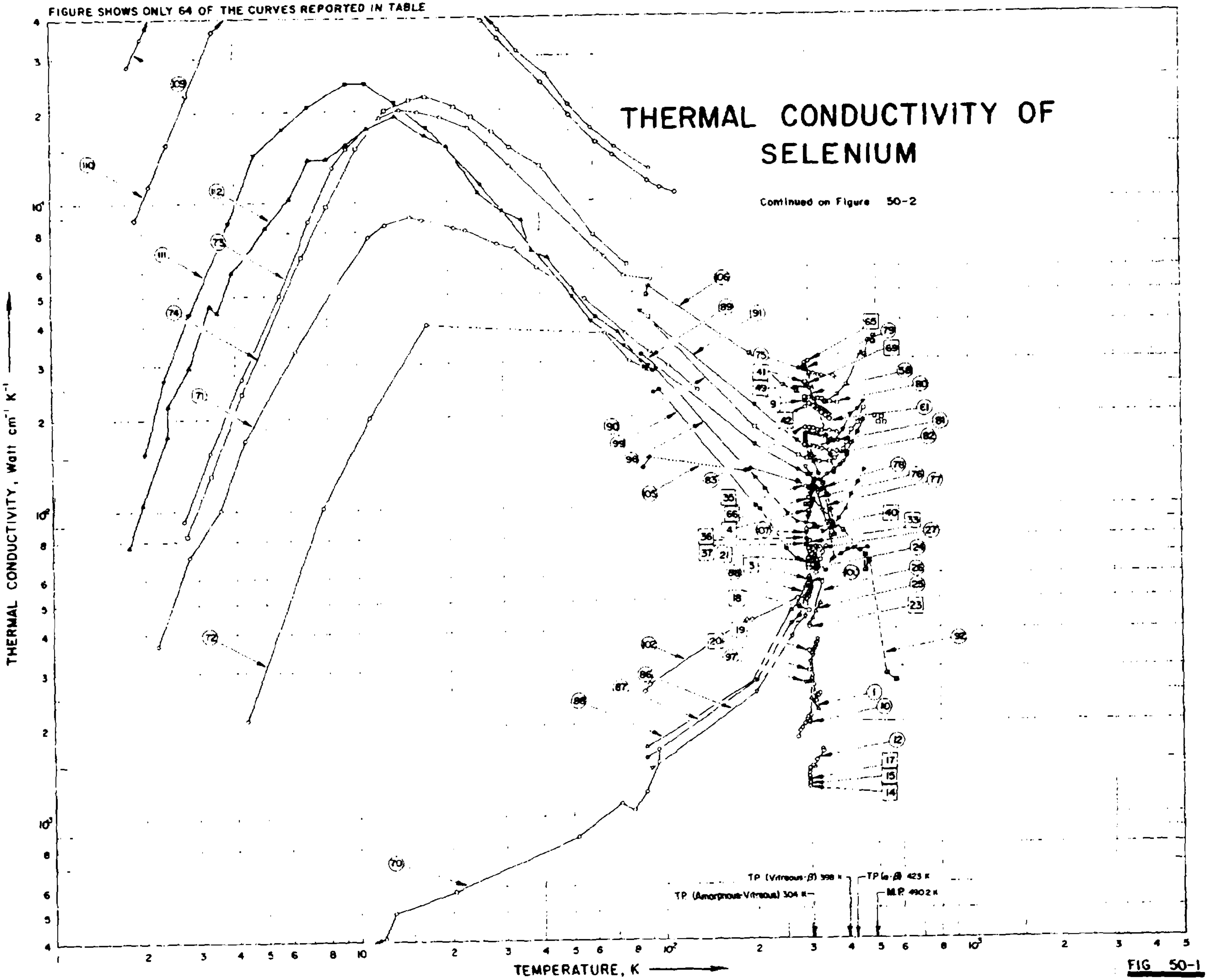


FIGURE SHOWS ONLY 64 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF SELENIUM
Continued on Figure 50-2
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
TP (Vitreous-β) 398 K
TP (α-β) 423 K
TP (Amorphous-Vitreous) 304 K
M.P. 490.2 K

FIG 50-1

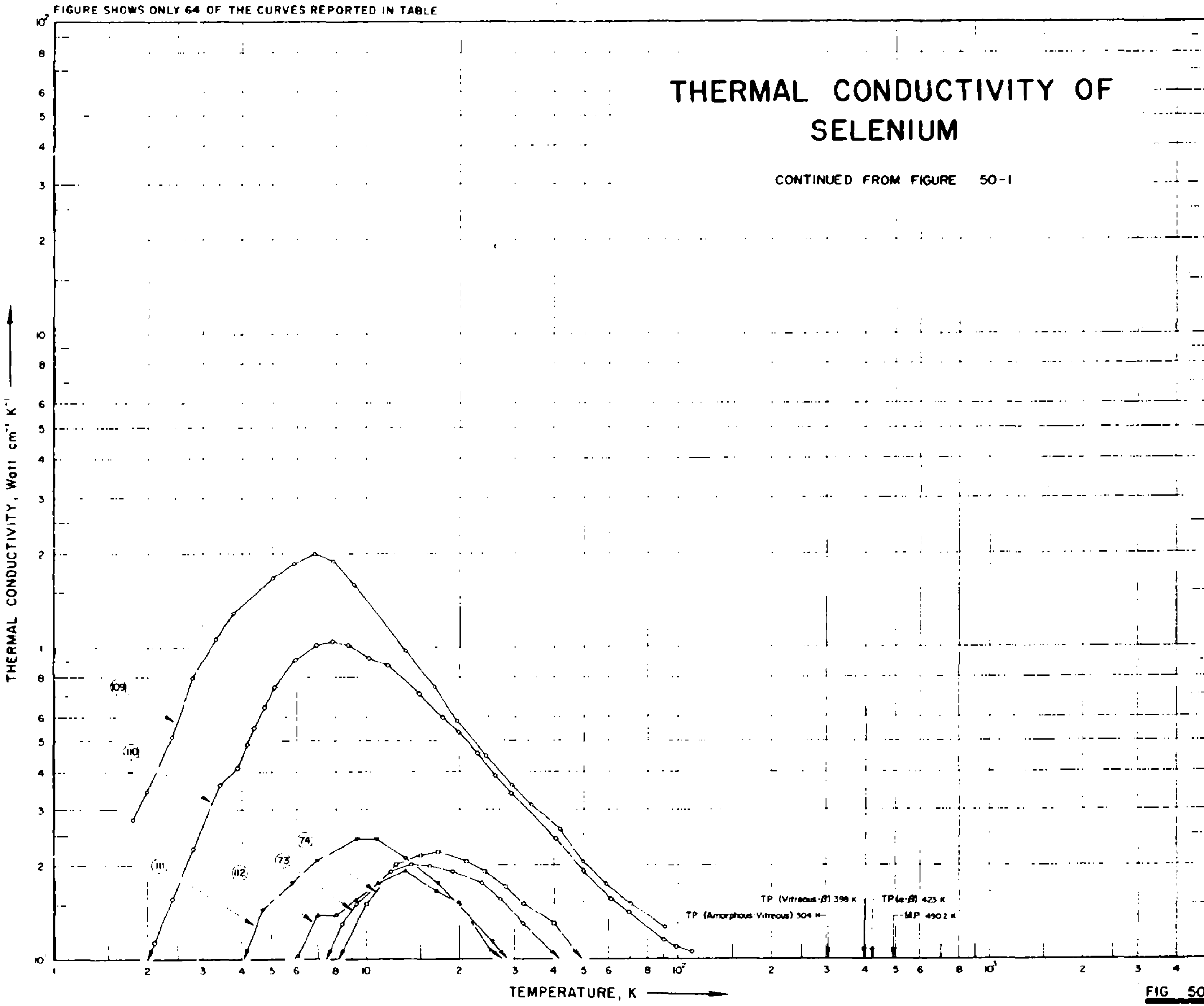


FIGURE SHOWS ONLY 64 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF SELENIUM
CONTINUED FROM FIGURE 50-1
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
(109)
(110)
(111)
(112)
(73)
(74)
TP (Vitreous-β) 398 K
TP (Amorphous Vitreous) 304 K
TP (α-β) 423 K
MP 490.2 K

FIG 50-2

SPECIFICATION TABLE NO. 50 THERMAL CONDUCTIVITY OF SELENIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 50]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	357	L	1943	301, 319	< 1.8		Pure.
2	358	L	1957	300.7	< 4		99.996 pure; vitreous and amorphous; specimen 20 mm in dia; polished.
3	358	L	1957	300.7	< 4		0.065 Br; same structure and dimensions as the above specimen; prepared by fusion in a molybdenum crucible, solidified and polished.
4	358	L	1957	300.7	< 4		0.13 Br; same structure, dimensions, and fabrication method as above.
5	358	L	1957	300.7	< 4		0.16 Br; same structure, dimensions, and fabrication method as above.
6	358	L	1957	293.2	< 4		99.996 pure; hexagonal crystalline; specimen 18 mm in dia; polished.
7	358	L	1957	293.2	< 4		0.065 Br; same structure and dimensions as the above specimen; prepared by melting vitreous selenium containing bromine in a ceramic crucible, pouring into a molybdenum beaker, first crystallization at 130 C for 30 min, then second crystallization at 200 C for 25 min, polished.
8	358	L	1957	293.2	< 4		0.13 Br; same structure, dimensions, and fabrication method as above.
9	358	L	1957	293.2	< 4		0.032 Br; same structure, dimensions, and fabrication method as above.
10	359	P	1956	273-323			Pure selenium from Merck; thermal conductivity values calculated from measured data of thermal diffusivity, specific volume, and the specific heat data taken from Tammann, G. and Von Gronow, H. E. (Z. Anorg. Allg. Chemie, 192, 193, 1930).
11	360	L	1917	298.2		Disc-1	Vitreous selenium; 6.5 cm in dia and about 0.5 cm thick; cast in a hot iron mould, aged for 7 yrs.
12	360	L	1917	297-331		Disc-2	Vitreous selenium; 6.5 cm dia x 0.7523 cm thick; cast in a hot iron mould, aged for 1 to 8 days.
13	360	L	1917	298.2		Disc-2	The above specimen re-tested after being aged for 1 yr.
14	360	L	1917	298.2		Disc-3	Vitreous selenium; 6.5 cm dia x ~0.5 cm thick; cast in a hot iron mould, aged for 10 days.
15	360	L	1917	298.2		Disc-3	The above specimen re-tested after being aged for 1 yr.
16	360	L	1917	298.2		Disc-4	Similar to above but prepared from highly purified selenium and aged for 10 days.
17	360	L	1917	298.2		Disc-5	Similar to above but aged for 2 days.
18	360	L	1917	298.2		Disc A-I	Crystalline specimen 6.5 cm dia x ~0.5 cm thick; prepared by heating the vitreous disk in an oil oven to 160 C for 1 hr, cooled slowly, ground and polished; aged for 11 days.
19	360	L	1917	298.2		Disc A-II	The above specimen aged for 164 days.
20	360	L	1917	298.2		Disc A-III	The above specimen aged for 1 yr.
21	360	L	1917	298.2		Disc B-I	Similar to the above specimen but prepared by heating at 170 C and aged for 16 days.
22	360	L	1917	298.2		Disc B-II	The above specimen aged for 134 days.

SPECIFICATION TABLE NO. 50 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
23	360	L	1917	298.2		Disc B-III	The above specimen aged for 1 yr.
24	360	L	1917	298-326		Disc C-I	Crystalline specimen; 6.5 cm dia x 0.5774 cm thick; prepared by heating at 180 C and aged for 38 days.
25	360	L	1917	298-326		Disc C-II	The above specimen re-tested after being aged for 95 days.
26	360	L	1917	298-330		Disc C-III	The above specimen re-tested after being aged for 1 yr.
27	360	L	1917	298-325		Disc D-I	Similar to the above specimen but prepared by heating at 192 C and aged for 28 days.
28	360	L	1917	298.2		Disc D-II	The above specimen re-tested after being aged for 148 days.
29	360	L	1917	298.2		Disc D-III	The above specimen re-tested after being aged for 1 yr.
30	360	L	1917	298.2		Disc E-I	Similar to the above specimen but prepared by heating at 200 C and aged for 9 days.
31	360	L	1917	298.2		Disc E-II	The above specimen re-tested after 156 days.
32	360	L	1917	298.2		Disc E-III	The above specimen re-tested after 1 yr.
33	360	L	1917	298.2		Disc F-I	Similar to the above specimen but prepared by heating at 214 C and aged for 42 days.
34	360	L	1917	298.2		Disc F-III	The above specimen re-tested after being aged for 1 yr.
35	361	L	1957	294		1	99.994 pure; amorphous; 20 mm dia cylindrical specimen.
36	361	L	1957	294		1	0.0035 Cl; amorphous; 20 mm dia cylindrical specimen.
37	361	L	1957	294		1	Similar to the above specimen but doped with 0.015 Cl.
38	361	L	1957	294		1	Similar to the above specimen but doped with 0.03 Cl.
39	361	L	1957	294		1	Similar to the above specimen but doped with 0.06 Cl.
40	361	L	1957	294		1	Similar to the above specimen but doped with 0.125 Cl.
41	361	L	1957	294		2	99.994 pure; crystalline; 20 mm dia cylindrical specimen; prepared from vitreous form by heating at 130 C for 40 min.
42	361	L	1957	294		2	Similar to above but doped with 0.015 Cl.
43	361	L	1957	294		2	Similar to above specimen but doped with 0.03 Cl.
44	361	L	1957	294		2	Similar to above specimen but doped with 0.06 Cl.
45	361	L	1957	294		2	Similar to above specimen but doped with 0.125 Cl.
46	361	L	1957	294		3	99.994 pure; crystalline; 20 mm dia cylindrical specimen; prepared from vitreous selenium by heating at 200 C for 40 min.
47	361	L	1957	294		3	Similar to above specimen but doped with 0.015 C.
48	361	L	1957	294		3	Similar to above specimen but doped with 0.03 C.
49	361	L	1957	294		3	Similar to above specimen but doped with 0.06 C.
50	361	L	1957	294		3	Similar to above specimen but doped with 0.125 C.

SPECIFICATION TABLE NO. 50 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
51	362	L	1957	291.7		1	99.996 pure; amorphous.
52	362	L	1957	291.7		2	Amorphous selenium doped with 0.0035 Cl.
53	362	L	1957	291.7		3	Similar to the above specimen but doped with 0.007 Cl.
54	362	L	1957	291.7		4	Similar to the above specimen but doped with 0.015 Cl.
55	362	L	1957	291.7		5	Similar to the above specimen but doped with 0.03 Cl.
56	362	L	1957	291.7		6	Similar to the above specimen but doped with 0.06 Cl.
57	362	L	1957	291.7		7	Similar to the above specimen but doped with 0.125 Cl.
58	363	L	1958	303-353		1	99.996 pure; crystalline.
59	363	L	1958	303-353		2	Crystalline selenium doped with 0.0035 Cl.
60	363	L	1958	303-353		3	Crystalline selenium doped with 0.007 Cl.
61	363	L	1958	303-353		4	Crystalline selenium doped with 0.015 Cl.
62	363	L	1958	303-353		5	Crystalline selenium doped with 0.06 Cl.
63	363	L	1958	303-353		6	Crystalline selenium doped with 0.03 Cl.
64	364	L	1957	299.2			99.994 pure; amorphous.
65	364	L	1957	299.2			99.994 pure; crystalline specimen formed by heating vitreous selenium at 214 C.
66	364	L	1957	299.2			0.069 I; amorphous specimen.
67	364	L	1957	299.2			0.069 I; crystalline specimen.
68	364	L	1957	299.2			0.103 I; amorphous specimen.
69	364	L	1957	299.2			0.103 I; crystalline specimen.
70	365	L	1958	1.9-95		Se 1	Glassy specimen ~3 cm long and 1 cm dia; prepared by melting selenium powder (of probable 99.9+ purity) in a split brass mold at about 250 C and quenching rapidly in ice water.
71	365	L	1958	2.2-130		Se 2	Polycrystalline; same dimensions and preparation method as above.
72	365	L	1958	4.3-90		Se 3	Crystalline; 6 cm long, 1 cm in dia; supplied by Fairmount Chemical Co. (Newark, N.J.).
73	365	L	1958	2.7-92		Se 4	Polycrystalline specimen ~4 cm long and 4 mm in dia; average grain dimensions ~20 μ; produced by melting 99.999 pure selenium powder (from Canadian Copper Refiners Ltd) under vacuum in a glass tube, chilling rapidly to produce solid rod of glassy selenium, and annealing in vacuo at about 210 C for 50-60 hrs.
74	365	L	1958	2.8-77		Se 5	Similar to the above specimen but having a regular triangular cross section of about 0.26 cm^2.

SPECIFICATION TABLE NO. 50 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
75	522	L	1961	293-363			99.996 pure; polycrystalline; specimen about 10 mm thick and 16 mm in dia; annealed at 110 C and 210 C for 1 hr.
76	522	L	1961	293-363			0.05 Tl; polycrystalline selenium specimen of similar dimensions as above; prepared by melting together 99.996 pure selenium and Tl_2Se in a vacuum of 10^{-4} mm Hg; annealed at 110 C and 210 C for 1 hr.
77	522	L	1961	293-363			Similar to the above specimen but doped with 0.0125 Tl.
78	522	L	1961	293-363			Similar to the above specimen but doped with 0.1 Tl.
79	791	L	1963	293-373		1	99.996 pure; crystalline; ~10 mm dia cylindrical specimen; heated at 215 C for 8 hrs.
80	791	L	1963	293-373		2	Similar to the above specimen but doped with 0.01 Bi.
81	791	L	1963	293-373		3	Similar to the above specimen but doped with 0.02 Bi.
82	791	L	1963	293-373		4	Similar to the above specimen but doped with 0.04 Bi.
83	791	L	1963	293-373		5	Similar to the above specimen but doped with 0.06 Bi.
84	791	L	1963	293-373		6	Similar to the above specimen but doped with 0.08 Bi.
85	791	L	1963	293-373		7	Similar to the above specimen but doped with 0.1 Bi.
86	792, 1012	L	1963	90-300	3-5	V-3	Amorphous; about 10 mm in dia; prepared from the melt of 99.999 pure selenium by rapid cooling in vacuum.
87	792, 1012	L	1963	87-300	3-5	V-4	Similar to above but prepared from 99.9999 pure selenium.
88	792, 1012	L	1963	87-300	3-5	V-5	Similar to above but prepared from 99.99999 pure selenium.
89	792, 1012	L	1963	85-453	3-5	V-3	Crystalline; about 10 mm in dia; prepared from the amorphous specimen V-3 by annealing in vacuum at 210 C for 50 hrs.
90	792, 1012	L	1963	90-453	3-5	V-4	Similar to above but prepared from the amorphous specimen V-4.
91	792, 1012	L	1963	85-455	3-5	V-5	Similar to above but prepared from the amorphous specimen V-5.
92	793, 934	P	1964	293-573	±10		Data cover both solid and liquid state.
93	805	L	1966	294-313	3	1	Amorphous selenium, glass-formation temp ~31 C.
94	805	L	1966	294-313	3	3	Amorphous selenium irradiated by an electron beam with an energy of 5 MeV for 30 min.
95	805	L	1966	294-313	3	2	Similar to above but irradiated for only 10 min.
96	805	L	1966	288-318	3	1	Amorphous selenium.
97	805	L	1966	288-318	3	3	0.197 P; amorphous.
98	806	L	1966	87-455			Hexagonal single crystal grown out of a melt of grade B5 selenium (99.99999 pure); each crystal being 15 x 2 x 2 mm in size; specimen dimensions 7 x 6 x 4 mm; measurement carried out in darkness under a vacuum of 10^{-4} mm Hg; heat flow parallel to crystal axis.

SPECIFICATION TABLE NO. 50 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
99	806	L	1966	93-465			Similar to above but measured perpendicular to crystal axis.
100	898	L	1966	293-315	3-5	B-5	99.99999 pure; prepared from the melt by rapid cooling in vacuum; vitrification temp 31 C.
101	898	L	1966	293-315	3-5		Doped with 0.05 Cd; prepared from the melt by rapid cooling in vacuum; vitrification temp 32.5 C.
102	898	L	1966	89-341	3-5	B-4	99.9999 pure; amorphous; prepared from the melt by rapid cooling in vacuum.
103	898	L	1966	86-338	3-5	B-4	Similar to the above specimen except annealed at 373 K for 0.5 hr.
104	898	L	1966	88-335	3-5	B-4	Similar to the above specimen except annealed at 373 K for 2 hrs.
105	898	L	1966	86-338	3-5	B-4	Similar to the above specimen except annealed at 373 K for 10 hrs.
106	898	L	1966	89-533	3-5		Crystalline specimen prepared from the amorphous phase (specimen B-4) by annealing in vacuum at 210 C for 60 hrs; includes the liquid phase.
107	898	L	1966	290-317	3-5		Doped with 0.05 Tl; amorphous specimen, prepared from the melt of 99.99999 pure selenium with admixture of thallium by rapid cooling in vacuum.
108	898	L	1966	291-317	3-5		Similar to the above specimen except doped with 0.125 Tl.
109	961	L	1967	1.8-94		A	Single crystal; specimen 1.46 mm^2 in cross section and 1.21 mm long; grown from the vapor phase; heat flow parallel to the c-axis (additional information and the tabulated data obtained from author).
110	961	L	1967	1.9-112		B	Single crystal; specimen 0.973 mm^2 in cross section and 0.98 mm long; grown from the melt, heat flow parallel to the c-axis (additional information and the tabulated data obtained from author).
111	961	L	1967	2.0-90		C	Cut from the same crystal as the above specimen. In the form of an almost circular platelet 12.1 mm in dia and 1.2 mm thick, with c-axis parallel to the flat faces; measured in the direction perpendicular to both the thickness and the c-axis, in the central portion of the platelet across a length of 2.5 mm with effective cross-section 15 mm^2 (additional information and the tabulated data obtained from author).
112	961	L	1967	1.8-89		D	Cut from the same crystal as the above specimen, in the form of an almost circular platelet 12.1 mm in dia and 1.60 mm thick, with c-axis parallel to the flat faces; measured in the direction perpendicular to both the thickness and the c-axis, in the central portion of the platelet across a length of 3.66 mm with effective cross-section 19.4 mm^2 (additional information and the tabulated data obtained from author).

DATA TABLE NO. 50 THERMAL CONDUCTIVITY OF SELENIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
301.2	0.00237
319.2	0.00220
CURVE 2	
300.7	0.0129
CURVE 3	
300.7	0.00573
CURVE 4	
300.7	0.00963
CURVE 5*	
300.7	0.00628
CURVE 6*	
293.2	0.0294
CURVE 7	
293.2	0.0142
CURVE 8*	
293.2	0.0178
CURVE 9	
293.2	0.0218
CURVE 10	
273.2	0.00179
278.2	0.00187
283.2	0.00191
288.2	0.00198
293.2	0.00205
CURVE 10 (cont.)	
295.2	0.00209
297.2	0.00200
299.2	0.00199
301.2	0.00210
303.2	0.00331
306.2	0.00282
308.2	0.00264
310.2	0.00247
313.2	0.00233
318.2	0.00243
323.2	0.00248
CURVE 11*	
298.2	0.00137
CURVE 12	
297.0	0.00136
297.1	0.00133
297.4	0.00139
297.7	0.00139
298.2	0.00136
298.3	0.00141
298.4	0.00142
306.9	0.00144
309.1	0.00143
314.1	0.00150
314.4	0.00150
330.4	0.00161
330.7	0.00163
CURVE 13*	
298.2	0.00138
CURVE 14	
298.2	0.00123
CURVE 15	
298.2	0.00126
CURVE 16*	
298.2	0.00137
CURVE 17	
298.2	0.00131
CURVE 18	
298.2	0.00460
CURVE 19	
298.2	0.00339
CURVE 20	
298.2	0.00293
CURVE 21	
298.2	0.00657
CURVE 22	
298.2	0.00544
CURVE 23	
298.2	0.00406
CURVE 24	
298.2	0.00623
299.6	0.00632
300.1	0.00628
300.3	0.00636
308.9	0.00636
319.2	0.00661
325.8	0.00665
CURVE 25	
298.2	0.00414
CURVE 25 (cont.)	
305.6	0.00435
305.6	0.00435
314.3	0.00456
325.8	0.00485
CURVE 26	
298.2	0.00406
300.4	0.00460
300.4	0.00464
301.7	0.00414
329.7	0.00561
CURVE 27	
298.2	0.00674
299.0	0.00724
299.6	0.00678
300.1	0.00690
307.4	0.00707
314.5	0.00703
325.2	0.00732
CURVE 28	
298.2	0.00464
CURVE 29	
298.2	0.00502
CURVE 30	
298.2	0.00703
CURVE 31	
298.2	0.00502
CURVE 32	
298.2	0.00460
CURVE 33	
298.2	0.00766
CURVE 34*	
298.2	0.00582
CURVE 35	
294.2	0.0115
CURVE 36	
294.2	0.00774
CURVE 37	
294.2	0.00745
CURVE 38	
294.2	0.00628
CURVE 39	
294.2	0.00766
CURVE 40	
294.2	0.00837
CURVE 41	
294.2	0.0251
CURVE 42	
294.2	0.0209
CURVE 43*	
294.2	0.0206
CURVE 44*	
294.2	0.0217
CURVE 45	
294.2	0.0226
CURVE 46*	
294.2	0.0272
CURVE 47	
294.2	0.0230
CURVE 48	
294.2	0.0210
CURVE 49	
294.2	0.0243
CURVE 50*	
294.2	0.0251
CURVE 51*	
291.7	0.0131
CURVE 52*	
291.7	0.00778
CURVE 53	
291.7	0.00728
CURVE 54*	
291.7	0.00741
CURVE 55*	
291.7	0.00623
CURVE 56*	
291.7	0.00766
CURVE 57*	
291.7	0.00849
CURVE 58	
303.2	0.0239
313.2	0.0220
323.2	0.0209
333.2	0.0205
345.7	0.0200
353.2	0.0196
CURVE 59*	
303.2	0.0233
313.2	0.0214
323.2	0.0213
333.2	0.0208
343.2	0.0203
353.2	0.0198
CURVE 60*	
303.2	0.0215
313.2	0.0211
323.2	0.0207
333.2	0.0203
343.2	0.0198
353.2	0.0194
CURVE 61	
303.2	0.0213
313.2	0.0208
320.7	0.0204
333.2	0.0199

* Not shown on plot

DATA TABLE NO. 50 (continued)

CURVE 61 (cont.)

T	k
343.2	0.0195
353.2	0.0190

CURVE 62

T	k
303.2	0.0212
313.2	0.0207
323.2	0.0203
333.2	0.0197
343.2	0.0193
353.2	0.0188

CURVE 63*

T	k
303.2	0.0210
313.2	0.0205
323.2	0.0201
333.2	0.0196
343.2	0.0192
353.2	0.0187

CURVE 64*

T	k
299.2	0.0128

CURVE 65*

T	k
299.2	0.0295

CURVE 66

T	k
299.2	0.0106

CURVE 67*

T	k
299.2	0.0266

CURVE 68*

T	k
299.2	0.00946

CURVE 69

T	k
299.2	0.0248

CURVE 70

T	k
1.9	0.00023
2.4	0.00025
3.1	0.00027
4.1	0.00036
4.4	0.000335
6.8	0.00037
8.8	0.000375
12.0	0.00041
13.0	0.00050
20.5	0.00058
52.0	0.00086
72.0	0.00110
79.0	0.00105
87.0	0.00120
95.0	0.00150
95.0	0.00165

CURVE 71

T	k
2.2	0.0037
2.8	0.0071
3.55	0.0101
4.3	0.017
6.3	0.033
8.3	0.0515
11.0	0.077
12.5	0.084
15.0	0.089
16.5	0.087
21.0	0.082
23.0	0.080
29.0	0.073
33.0	0.070
39.0	0.061
56.0	0.048
76.0	0.037
91.0	0.032
105.0	0.029
130.0	0.024

CURVE 72

T	k
4.3	0.0021
7.7	0.0102

CURVE 72 (cont.)

T	k
11.0	0.0199
17.0	0.040
65.0	0.037
78.0	0.030
90.0	0.028

CURVE 73

T	k
2.7	0.0093
3.3	0.0155
4.2	0.027
5.6	0.050
7.0	0.087
8.4	0.130
9.3	0.150
12.0	0.190
14.0	0.200
16.0	0.198
19.0	0.190
23.5	0.175
27.0	0.155
32.0	0.130
61.0	0.069
65.0	0.066
75.0	0.057
92.0	0.055

CURVE 74

T	k
2.75	0.0083
3.3	0.0130
4.2	0.0240
6.6	0.0670
8.0	0.097
10.0	0.150
12.5	0.200
15.0	0.215
17.0	0.220
21.0	0.205
24.0	0.190
28.0	0.170
32.0	0.150
40.0	0.130
60.0	0.077
77.0	0.062

CURVE 75

T	k
293.2	0.0280
303.2	0.0264
323.3	0.0209*
343.2	0.0167
353.2	0.0146
363.2	0.0126

CURVE 76

T	k
293.2	0.0133
303.2	0.0126
313.2	0.0117
323.2	0.0109
333.2	0.0096
343.2	0.0088
353.2	0.0079
363.2	0.0067

CURVE 77

T	k
293.2	0.0167
313.2	0.0142
333.2	0.0117
353.2	0.0088
363.2	0.0079

CURVE 78

T	k
293.2	0.0159
303.2	0.0146
313.2	0.0138
323.2	0.0126
333.2	0.0121*
343.2	0.0108
353.2	0.0096
363.2	0.0084

CURVE 79

T	k
293	0.0291
303	0.0269
313	0.0267
323	0.0266
333	0.0264
353	0.0262
373	0.0258

CURVE 80

T	k
293	0.0223
303	0.0222
313	0.0220
323	0.0220
333	0.0220
353	0.0216
373	0.0213

CURVE 81

T	k
293	0.0172
303	0.0172
313	0.0170
323	0.0170
333	0.0167
353	0.0164
373	0.0162

CURVE 82

T	k
293	0.0157
303	0.0157
313	0.0155
323	0.0155
333	0.0153
353	0.0151
373	0.0149

CURVE 83

T	k
293	0.0179
303	0.0178
313	0.0177
323	0.0176
333	0.0175
353	0.0175
373	0.0173

CURVE 84*

T	k
293	0.0195
303	0.0195
313	0.0193
323	0.0192
333	0.0191

CURVE 84* (cont.)

T	k
353	0.0190
373	0.0189

CURVE 85*

T	k
293	0.0210
303	0.0210
313	0.0209
323	0.0208
333	0.0207
353	0.0205
373	0.0203

CURVE 86

T	k
90	0.00142
200	0.00251
263	0.00377
275	0.00418
290	0.00439
300	0.00502

CURVE 87

T	k
87	0.00155
200	0.00272
260	0.00418
277	0.00439
290	0.00502
300	0.00544

CURVE 88

T	k
87	0.00167
197	0.00272
260	0.00460
275	0.00481
290	0.00544
300	0.00586

CURVE 89

T	k
85	0.0314
200	0.0159
277	0.0130
297	0.0126

CURVE 89 (cont.)

T	k
315	0.0121
328	0.0121
345	0.0126
365	0.0130
380	0.0134
390	0.0138
400	0.0146
415	0.0159
435	0.0172
453	0.0188

CURVE 90

T	k
90	0.0418
200	0.0180
277	0.0146
295	0.0142
325	0.0138
350	0.0138
365	0.0142
390	0.0151
400	0.0159
415	0.0176
435	0.0184
453	0.0205

CURVE 91

T	k
85	0.0435
200	0.0213
275	0.0163
297	0.0155
325	0.0155
347	0.0159
365	0.0163
390	0.0176
415	0.0192
435	0.0209
455	0.0230

CURVE 92

T	k
293	0.010
303	0.0104
388	0.00825
455	0.00682

* Not shown on plot

DATA TABLE NO. 50 (continued)

CURVE 92 (cont.)

T	k
455	0.00610
471	0.00655
535	0.00285
573	0.00270

CURVE 93

T	k
294.2	0.00494
297.3	0.00498
300.0	0.00502
302.8	0.00519
303.2	0.00552
303.7	0.00628
304.2	0.00707
305.4	0.00669
306.4	0.00644
307.2	0.00628
308.4	0.00644
310.0	0.00644
310.4	0.00653
311.4	0.00653
313.4	0.00665

CURVE 94

T	k
294.2	0.00707
297.2	0.00690
297.5	0.00686
297.7	0.00686
299.6	0.00686
301.8	0.00669
304.2	0.00661
305.8	0.00563
309.1	0.00644
313.2	0.00649

CURVE 95

T	k
294.2	0.00655
295.8	0.00669
300.2	0.00703
301.8	0.00707
303.2	0.00711
304.9	0.00728
306.0	0.00828
307.4	0.00828
310.9	0.00841
313.1	0.00849

CURVE 96

T	k
298.2	0.00502
290.0	0.00502
292.2	0.00502
294.2	0.00502
295.7	0.00502
297.5	0.00523
299.5	0.00544
301.2	0.00523
302.2	0.00523
303.2	0.00606
303.7	0.00669
304.2	0.00732
305.5	0.00669
306.2	0.00649
308.5	0.00669
309.7	0.00690
311.7	0.00732
313.2	0.00753
315.0	0.00774
316.7	0.00816
318.0	0.00837

CURVE 97

T	k
288.2	0.00266
290.0	0.00266*
291.5	0.00264*
293.2	0.00268*
295.5	0.00268
297.2	0.00268*
299.0	0.00268
300.7	0.00310
302.2	0.00310*
304.7	0.00320*
306.7	0.00326
308.5	0.00331*
309.7	0.00339
311.0	0.00341
312.2	0.00345
314.0	0.00354
316.0	0.00358
318.0	0.00368

CURVE 98

T	k
87	0.0285
93	0.0277
95	0.0282
200	0.0123

CURVE 98 (cont.)

T	k
215	0.0114
255	0.00941
275	0.00879
293	0.00870
313	0.00858
333	0.00816
355	0.00837
375	0.00900
395	0.00962
413	0.0107
435	0.0117
455	0.0129

CURVE 99

T	k
93	0.0236
97	0.0241
97	0.0238*
200	0.010
207	0.00975
253	0.00724
275	0.00669
297	0.00640*
320	0.00640
340	0.00607
360	0.00669
380	0.00690
400	0.00711
420	0.00724
440	0.00711
465	0.00724

CURVE 100

T	k
292.6	0.00497*
294.6	0.00505*
297.2	0.00509*
299.7	0.00521
301.6	0.00531
302.9	0.00544*
303.3	0.00545*
303.6	0.00551
303.6	0.00725
304.1	0.00699*
304.8	0.00665
306.3	0.00621*
307.1	0.00620*
308.3	0.00634*
309.9	0.00656

CURVE 100 (cont.)

T	k
311.1	0.00671*
312.2	0.00679
313.2	0.00695*
315.0	0.00727

CURVE 101*

T	k
292.6	0.00411
296.5	0.00416
299.2	0.00413
301.6	0.00428
303.8	0.00418
304.6	0.00421
305.5	0.00743
306.7	0.00690
306.9	0.00675
308.8	0.00663
311.7	0.00711
313.2	0.00745
315.1	0.00774

CURVE 102

T	k
86	0.00252
89	0.00266
186	0.00428
193	0.00428
275	0.00496
293	0.00496
299	0.00510*
303	0.00556*
304	0.00697*
308	0.00642*
314	0.00599
319	0.00660*
324	0.00675*
331	0.00704
336	0.00720*
341	0.00727

CURVE 103*

T	k
86	0.00383
183	0.00512
188	0.00546
273	0.00630
297	0.00636
300	0.00707
304	0.00786

CURVE 103 (cont.)*

T	k
313	0.00757
321	0.00771
328	0.00775
332	0.00786
338	0.00786

CURVE 104*

T	k
88	0.00808
185	0.00834
190	0.00874
274	0.00874
295	0.00890
303	0.00870
308	0.00886
315	0.00890
323	0.00886
330	0.00911
335	0.00928

CURVE 105

T	k
86	0.0134
90	0.0144
186	0.0129
192	0.0131
275	0.0118
294	0.0115*
300	0.0113
307	0.0114
316	0.0113
324	0.0111*
331	0.0112
338	0.0111*

CURVE 106

T	k
89	0.0489
90	0.0520
193	0.0313
248	0.0245
274	0.0233
300	0.0216*
318	0.0216*
339	0.0216
371	0.0227
399	0.0252
443	0.0309
456	0.0305

CURVE 106 (cont.)*

T	k
471	0.0337
487	0.0335
492	0.0350
494	0.0192
508	0.0184
524	0.0191
533	0.0184

CURVE 107

T	k
290.8	0.00766*
293.4	0.00903
296.9	0.00874*
298.9	0.00912
300.5	0.00933
302.0	0.00962*
302.9	0.0108*
303.2	0.0102*
304.2	0.00983
304.8	0.0101
305.9	0.0107
308.9	0.0110
312.4	0.0112*
314.4	0.0113*
317.0	0.0115*

CURVE 108*

T	k
290.9	0.0141
292.0	0.0141
294.0	0.0138
297.0	0.0140
299.1	0.0139
301.3	0.0141
302.3	0.0144
303.3	0.0145
304.4	0.0147
305.4	0.0147
307.0	0.0147
308.3	0.0147
309.6	0.0147
311.1	0.0147
312.8	0.0147
314.3	0.0148
316.7	0.0147

CURVE 109

T	k
1.77	0.272
1.98	0.338
2.36	0.51
2.80	0.78
3.35	1.05
3.85	1.26
5.10	1.63
6.08	1.82
7.02	1.96
8.04	1.84
9.50	1.52
13.8	0.94
17.1	0.72
20.2	0.555
25.6	0.428
30.1	0.345
35.2	0.295
43.1	0.247
51.6	0.194
60.7	0.166
72.7	0.142
93.8	0.120

CURVE 110

T	k
1.88	0.087
2.09	0.112
2.38	0.152
2.77	0.217
3.38	0.355
3.88	0.40
4.18	0.472
4.38	0.535
4.75	0.63
5.16	0.725
6.1	0.88
7.0	0.98
7.88	1.02
8.88	0.98
10.5	0.88
12.1	0.83
15.2	0.67
17.9	0.57
20.1	0.505
23.4	0.43
26.6	0.367
30.1	0.322
40.9	0.229
50.9	0.182

CURVE 110 (cont.)

T	k
62.5	0.146
70.8	0.133
92.1	0.109
100.2	0.104
112.0	0.101

CURVE 111

T	k
1.96	0.0154
2.34	0.0266
2.78	0.043
3.84	0.084
4.59	0.141
5.92	0.169
7.04	0.202
9.45	0.236
11.0	0.226
13.8	0.203
17.2	0.166
25.8	0.109
51.2	0.047
59.1	0.0388
75.5	0.0322
89.6	0.0285

CURVE 112

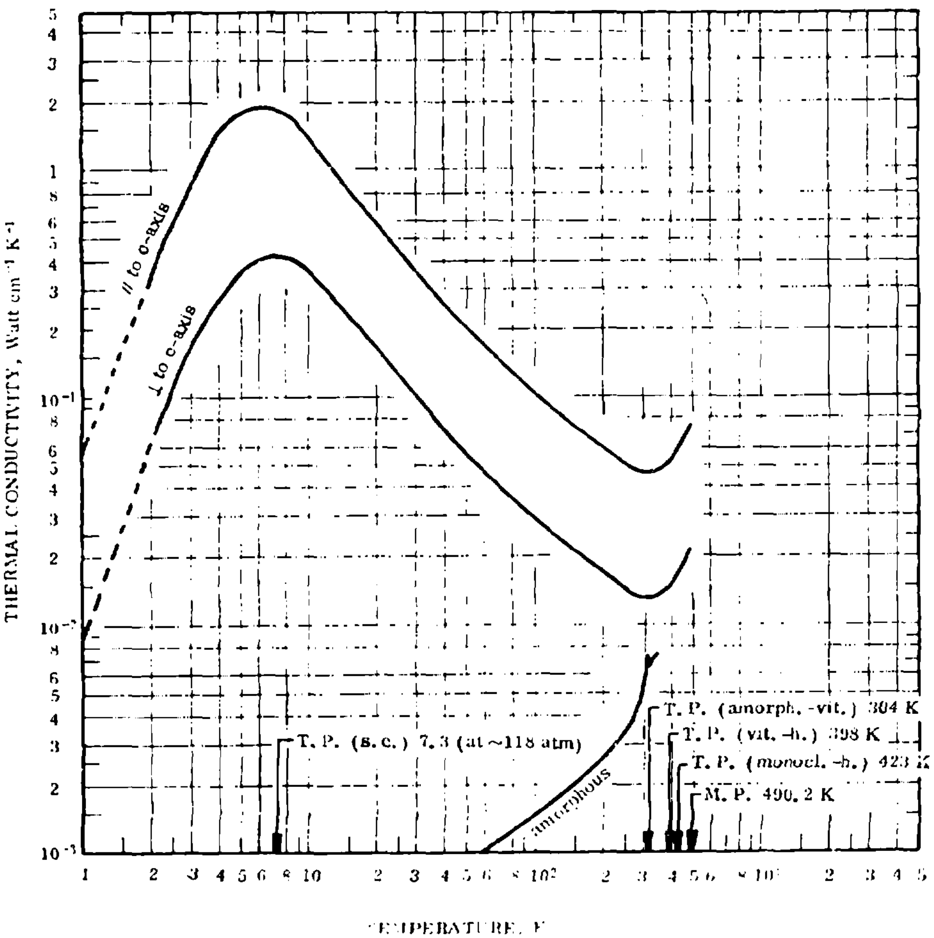
T	k
1.76	0.0077
1.96	0.0108
2.36	0.0172
2.36	0.0216
2.79	0.0292
3.29	0.0461
3.48	0.0438
3.91	0.0588
5.01	0.081
6.03	0.10
7.08	0.134
8.02	0.133
9.38	0.149
11.1	0.169
13.6	0.185
17.2	0.158
25.6	0.102
30.3	0.0885
35.2	0.083
37.8	0.0665
42.6	0.0635

* Not shown on plot

DATA TABLE NO. 50 (continued)

T	k
CURVE 112 (cont.)	
51.3	0.0494
60.9	0.0402
72.8	0.036
88.7	0.0266

FIGURE AND TABLE NO. 50R RECOMMENDED THERMAL CONDUCTIVITY OF SELENIUM



RECOMMENDED VALUES*

Single Crystal

T_1	k_1 (// to c-axis)	k_2 (// to c-axis)	k_1 (⊥ to c-axis)	k_2 (⊥ to c-axis)	T_2
0	0	0	0	0	-459.7
1	(0.0563) ‡	(3.25)	(0.00865)	(0.500)	-457.9
2	0.353	20.4	(0.0600)	(3.47)	-456.1
3	0.855	49.4	0.160	9.24	-454.3
4	1.41	81.5	0.268	15.5	-452.5
5	1.75	101	0.348	20.1	-450.7
6	1.92	111	0.395	22.8	-448.9
7	1.90	110	0.410	23.7	-447.1
8	1.78	103	0.406	23.5	-445.3
9	1.61	93.0	0.390	22.5	-443.5
10	1.42	82.0	0.359	20.7	-441.7
11	1.26	72.8	0.329	19.0	-439.9
12	1.12	64.7	0.301	17.4	-438.1
13	1.01	58.4	0.276	15.9	-436.3
14	0.919	53.1	0.253	14.6	-434.5
15	0.844	48.8	0.234	13.5	-432.7
16	0.778	45.0	0.217	12.5	-430.9
18	0.672	38.8	0.189	10.9	-427.3
20	0.588	34.0	0.166	9.59	-423.7
25	0.448	25.9	0.127	7.34	-414.7
30	0.362	20.9	0.103	5.95	-405.7
35	0.303	17.5	0.0866	5.00	-396.7
40	0.260	15.0	0.0743	4.29	-387.7
45	0.228	13.2	0.0651	3.76	-378.7
50	0.203	11.7	0.0580	3.35	-369.7
60	0.168	9.71	0.0480	2.77	-351.7
70	0.144	8.32	0.0411	2.37	-333.7
80	0.126	7.28	0.0360	2.08	-315.7
90	0.112	6.47	0.0320	1.85	-297.7
100	0.103	5.95	0.0294	1.70	-279.7
150	0.0762	4.40	0.0218	1.26	-189.7
200	0.0608	3.51	0.0174	1.01	- 99.7
250	0.0513	2.96	0.0147	0.849	- 9.7
273.2	0.0481	2.78	0.0137	0.792	32.0
300	0.0452	2.61	0.0130	0.751	80.3
350	0.0461	2.66	0.0132	0.763	170.3
400	0.0538	3.11	0.0154	0.890	260.3
490.2	0.0747	4.32	0.0213	1.23	422.7

REMARKS

The recommended values are for high-purity selenium. The recommended values for selenium single crystals that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures above 20 K. Below 20 K the values are intended only for indicating the general trend, since the thermal conductivity near and below the corresponding temperature of its maximum is highly sensitive to small physical and chemical variations of the specimens. The recommended values for amorphous selenium are thought to be accurate to within 10%.

* T_1 in K, k_1 in Watt $cm^{-1} K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$.

‡ Values in parentheses are extrapolated or estimated.

TABLE NO. 50R (continued)

RECOMMENDED VALUES*

Amorphous

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2*
0	0	0	-459.7	304	0.00732	0.423	87.5
1	(0.000130)‡	(0.00751)	-457.9	304.5	0.00681	0.393	88.4
2	0.000236	0.0136	-456.1	305	0.00657	0.380	89.3
3	0.000290	0.0168	-454.3	305.5	0.00640	0.370	90.2
4	0.000323	0.0187	-452.5				
5	0.000342	0.0198	-450.7	306	0.00627	0.362	91.1
6	0.000358	0.0207	-448.9	306.5	0.00619	0.358	92.0
7	0.000374	0.0216	-447.1	307	0.00619	0.358	92.9
8	0.000390	0.0225	-445.3	307.5	0.00625	0.361	93.8
9	0.000405	0.0234	-443.5				
10	0.000420	0.0243	-441.7	308	0.00631	0.365	94.7
11	0.000435	0.0251	-439.9	309	0.00644	0.372	96.5
12	0.000450	0.0260	-438.1	310	0.00656	0.379	98.3
13	0.000465	0.0269	-436.3	320	0.00782	0.452	116.3
14	0.000480	0.0277	-434.5				
15	0.000494	0.0285	-432.7				
16	0.000508	0.0294	-430.9				
18	0.000534	0.0309	-427.3				
20	0.000560	0.0324	-423.7				
25	0.000619	0.0358	-414.7				
30	0.000675	0.0390	-405.7				
35	0.000730	0.0422	-396.7				
40	0.000788	0.0455	-387.7				
45	0.000843	0.0487	-378.7				
50	0.000920	0.0520	-369.7				
60	0.00102	0.0589	-351.7				
70	0.00113	0.0653	-333.7				
80	0.00125	0.0722	-315.7				
90	0.00136	0.0786	-297.7				
100	0.00148	0.0855	-279.7				
150	0.00204	0.118	-189.7				
200	0.00263	0.152	- 99.7				
250	0.00360	0.208	- 9.7				
273.2	0.00428	0.247	32.0				
290	0.00484	0.280	62.3				
295	0.00504	0.291	71.3				
300	0.00528	0.305	80.3				
301	0.00533	0.308	82.1				
302	0.00538	0.311	83.9				
303	0.00544	0.314	85.7				
303.5	0.00547	0.316	86.6				

* T_1 in K, k_1 in Watt $cm^{-1} K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$.

‡ Values in parentheses are extrapolated.

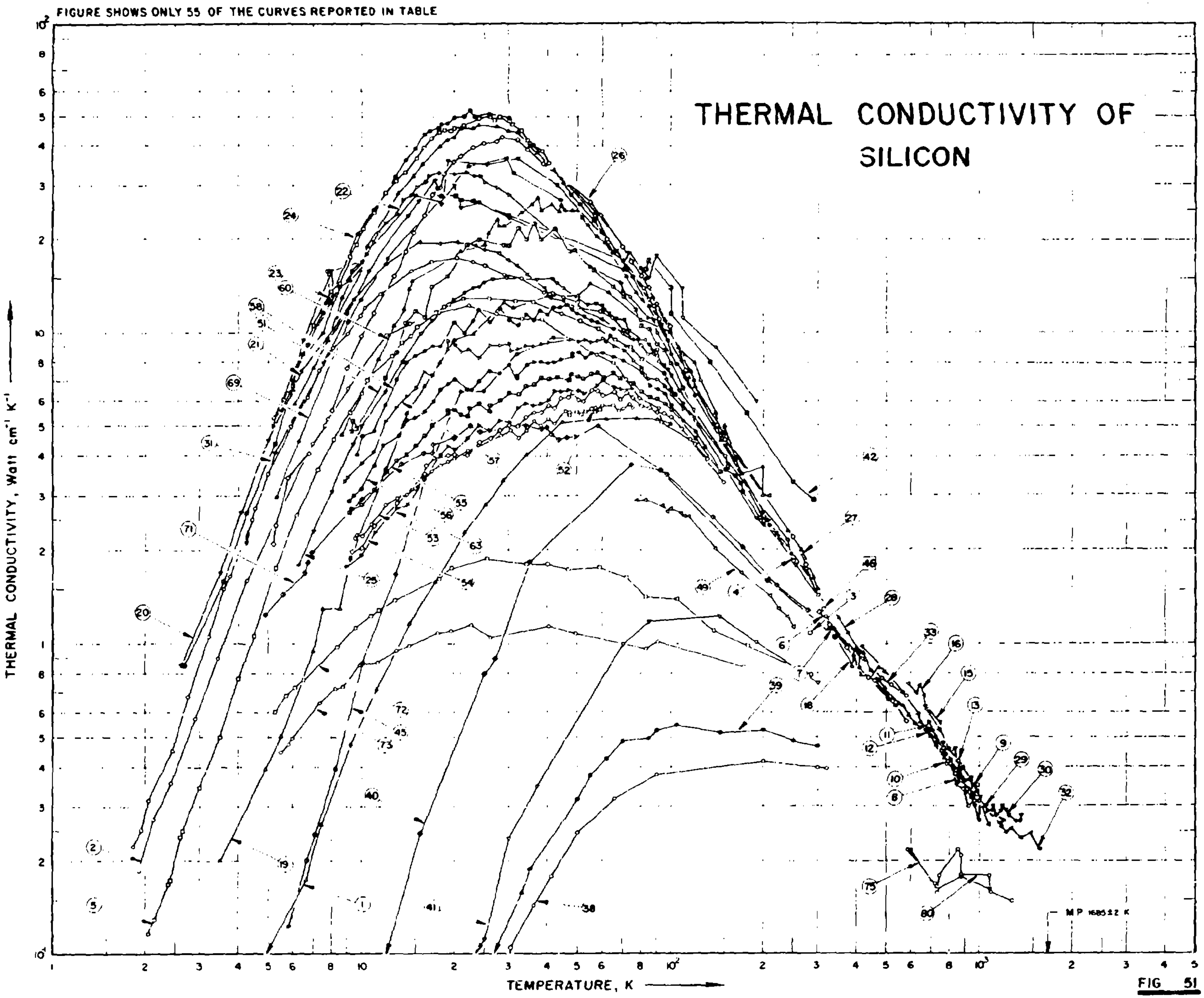


FIGURE SHOWS ONLY 55 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF SILICON
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M P 1685±2 K

FIG 51

SPECIFICATION TABLE NO. 51 THERMAL CONDUCTIVITY OF SILICON

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 51]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	274	L	1954	1.7-100		Si 1	High purity; polycrystalline, composed of fairly large crystallites about 0.2 mm in size; specimen 1 cm long, 1.5 mm^2 cross section; supplied by Messrs. Johnson Matthey Co.; nickel plated to solder thermal contacts, excess nickel dissolved with acid.
2	343	L	1956	1.9-149	1-5	Si 1	Pure single crystal; n-type; specimen cross sectional area 1.75 x 1.5 mm^2; electrical resistivity 6.7 ohm cm at 295 K.
3	351		1954	283	5-8		Pure crystal.
4	354	L	1957	1.8-300		Si 2	Pure single crystal; n-type; axis of specimen along [100] direction; 5 x 0.215 x 0.198 cm; carrier concentration 5 x 10^{14} cm^{-3}; electrical resistivity 15-25 ohm cm at room temp.
5	354	L	1957	2.1-80		Si 3	Gold-doped single crystal; p-type; axis of specimen [100] direction; 5 x 0.236 x 0.221 cm; carrier concentration 10^{15} cm^{-3}; electrical resistivity 18-26 ohm cm at room temp.
6	578	C	1960	303-579	±5		Pure single crystal; p-type; electrical resistivity 3 ohm cm at room temp; FH stainless steel used as comparative material.
7	578	C	1960	328-533	±5		Pure single crystal; n-type; electrical resistivity 3 ohm cm at room temp. FH stainless steel used as comparative material.
8	692, 745	C	1962	767, 846	±20	KA-1 (Knapic)	p-type single crystal; 23 mm dia x 8 mm thick; specimen axis in (111) orientation; supplied by Knapic Electro-Physics; carrier concentration 10^{18} cm^{-3}. Armco iron used as comparative material.
9	692, 745	C	1962	769-989	±20	KA-1 (Knapic)	Second run of the above specimen.
10	692, 745	C	1962	756-997	±20	KA-1 (Knapic)	Third run of the above specimen.
11	692, 745	C	1962	687, 826	±20	KA-1 (Knapic)	Fourth run of the above specimen.
12	692, 745	C	1962	679, 778	±20	KB-1 (Knapic)	n-type single crystal; 23 mm dia x 8 mm thick; specimen axis in (111) orientation; supplied by Knapic Electro-Physics; carrier concentration 5 x 10^{16} cm^{-3}; Armco iron used as comparative material.
13	692, 745	C	1962	857, 906	±20	KB-2 (Knapic)	Similar to above.
14	692, 745	C	1962	748	±20	KB-2 (Knapic)	Second run of above specimen.
15	692, 745	C	1962	669-1092	±20	KB-2 (Knapic)	Third run of above specimen.

SPECIFICATION TABLE NO. 51 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
16	678	E	1962	588-1073			p-type single crystal; 0.25 in. dia x 1.5 in. long; corrected for isothermal conditions and shield.
17	678	E	1962	593-883			The above specimen held for some time at 1073 K; measured in the cooling-down period.
18	678	E	1962	334-473			The above specimen measured with the length of the thermocouple wire between junctions and shield increased by a factor of approx two to three.
19	679	L	1961	3.5-210	10	Q-20	p-type single crystal; boron doped (1×10^{15} atoms cm^{-3}); O concentration, 2×10^{17} atoms cm^{-3}; dimensions 3 x 3 x 20 mm; supplied by H. L. Taylor, Texas Instruments, Inc.; electrical resistivity reported as 7.2 ohm cm at 0 C.
20	679	L	1961	2.6-190	10	M-1	p-type single crystal; boron doped (2×10^{12} atoms cm^{-3}); oxygen concentration, 10^{17} cm^{-3}; dimensions 3 x 3 x 20 mm; supplied by F. J. Bourassa, Electronics Chemical Div., Merck and Co., Inc.; electrical resistivity reported as 2000 ohm cm at 0 C.
21	680	L	1961	5.5-246		K4	n-type single crystal; oxygen concentration, 1.4×10^{18} cm^{-3}; specimen cross section 0.625 x 0.627 cm; carrier concentration 3.5×10^{14} cm^{-3}; dislocation density of the order of 10^4 cm^{-2}; electrical resistivity reported as 12 ohm cm at room temp.
22	680	L	1961	5.2-208		K5	n-type single crystal; oxygen concentration, 6×10^{17} cm^{-3}; specimen cross section 0.622 x 0.622 cm; carrier concentration 3.5×10^{13} cm^{-3}; dislocation density of the order of 10^4 cm^{-2}; electrical resistivity reported as 110 ohm cm at room temp.
23	680	L	1961	5.3-200		M6	n-type single crystal; phosphorus doped, oxygen concentration, $\sim 10^{16}$ cm^{-3}; carrier concentation 1.1×10^{15} cm^{-3}; specimen cross section, 0.634 x 0.640 cm; dislocation density of the order of 10^4 cm^{-2}; electrical resistivity reported as 5 ohm cm at room temp.
24	680	L	1961	6-120		M4	n-type single crystal; phosphorus doped, oxygen concentration $\sim 10^{16}$ cm^{-3}; carrier concentration 4×10^{13} cm^{-3}; cross section 0.637 x 0.629 cm; dislocation density of the order of 10^4 cm^{-2}; electrical resistivity reported as 260 ohm cm at room temp.
25	680	L	1961	6.3-298		SA-1	p-type single crystal; boron doped; oxygen concentration 7×10^{17} cm^{-3}; cross section 0.616 x 0.623 cm; carrier concentration 4.8×10^{15} cm^{-3}; electrical resistivity reported as 3.0 ohm cm at room temp.
26	680	L	1961	5.2-275		M3	p-type single crystal; boron doped; oxygen concentration $\sim 10^{16}$ cm^{-3}; cross section 0.635 x 0.632 cm; carrier concentration 4.0×10^{15} cm^{-3}; dislocation density of the order of 10^4 cm^{-2}; electrical resistivity reported as 4.5 ohm cm at room temp.
27	680	L	1961	5.9-300		M2	p-type single crystal; boron doped; oxygen concentration $\sim 10^{16}$ cm^{-3}; specimen cross section 0.630 x 0.640 cm; carrier concentration 4.0×10^{14} cm^{-3}; dislocation density of the order of 10^4 cm^{-2}; electrical resitivity reported as 45.5 ohm cm at room temp.

SPECIFICATION TABLE NO. 51 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
28	681, 660	P	1963	300-850		4A	p-type single crystal; specimen axis in [111] orientation; 0.9 cm in dia, 6 cm long; electrical resistivity reported as 107 ohm cm at 300 K; thermal conductivity values calculated from measured data of thermal diffusivity using the specific heat data taken from Dennison, D. H. (Institute for Atomic Research, Ames, Iowa) and density (determined by Smakula, A. and Sils, V.) 2.32902 ±3 x 10^{-5} g cm^{-3} at 298 K.
29	681, 660	P	1963	775-1200		1F	n-type single crystal; 0.9 cm in dia, 6 cm long; specimen axis in [111] orientation; electrical resistivity reported as 33.9, 50.0, 58.0, 42.0, 6.2, and 0.1 ohm cm at 300, 400, 460, 500, 650, and 1000 K, respectively; thermal conductivity values calculated by the same method as above.
30	681, 660	P	1963	1115-1370		3C	n-type single crystal; 0.9 cm in dia, 6 cm long; specimen axis in [100] orientation; electrical resistivity reported as 1010, 2000, 1700, 125, 6.2, and 0.1 ohm cm at 300, 375, 400, 500, 650, and 1000 K, respectively; thermal conductivity values calculated by the same method as above.
31	684	L	1964	4.3-304	±5		High purity; p-type single crystal; specimen axis in [111] orientation; 2 cm long and average dia 0.44 cm; vacancy clusters < 1 μ in dia; electrical resistivity reported as ~2000 ohm cm at room temp; measured in helium atmosphere.
32	684	R	1964	418-1577	±5		n-type single crystal; 2.6 cm dia x ~13 cm long; axis of cylinder in [111] direction; produced by floating zone process in argon atmosphere; dislocation density of the order of 10^5 cm^{-2}; carrier concentration, 1.27 x 10^{13} cm^{-3}; electrical resistivity reported as 440 ohm cm at room temp; measured in helium atmosphere; after the measurement, room temp resistivity dropped to 177 ohm cm, carrier concentration rose to 2.46 x 10^{13} cm^{-3}.
33	747, 746	C	1961	320-578		S-B-1	Single crystal; p-type; impurity concentration 2 x 10^{15} atoms cm^{-3}; supplied by Battelle Memorial Institute; ground to a dia of 11.8 mm and sliced to 7 mm thick; measured in a vacuum of 10^{-5} mm Hg; Armco iron (99.9$^+$ Fe) used as comparative material.
34	747, 746	C	1961	300-495		S-B-1	Second run of the above specimen.
35	747, 746	C	1961	404, 307		S-B-1	Third run of the above specimen.
36	747, 746	C	1961	302-467		S-B-2	Similar to above except impurity concentration 6 x 10^{14} atoms cm^{-3}.
37	747, 746	C	1961	336-394		S-B-2	Second run of the above specimen.
38	748	L	1964	10-320	±5	R-3	Polycrystalline, p-type; major impurity boron, 5 x 10^{20} atoms cm^{-3}; 1.24 cm effective dia, 3.2 cm long; electrical conductivity reported as 3.8 x 10^{3} ohm^{-1} cm^{-1} at 300 K.
39	748	L	1964	2.1-300	±5	R-5	Synthetic single crystal, p-type; major impurity boron, 3 x 10^{20} atoms cm^{-3}; 0.56 cm effective dia, 2.6 cm long; electrical conductivity reported as 2.2 x 10^{3} ohm^{-1} cm^{-1} at 300 K.

SPECIFICATION TABLE NO. 51 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
40	748	L	1964	3.2-340	±5	R-6	Synthetic single crystal, n-type; major impurity phosphorus, 2.0 x 10^{19} atoms cm^{-3}; 1.20 cm effective dia, 3.2 cm long; electrical conductivity reported as 3.6 x 10^{2} ohm^{-1} cm at 300 K.
41	748	L	1964	3.8-300	±5	R-55	Synthetic single crystal, n-type; major impurity phosphorus, 1.7 x 10^{20} atoms cm^{-3}; 0.55 cm effective dia, 1.7 cm long; electrical conductivity reported as 1.5 x 10^{3} ohm^{-1} cm^{-1} at 300 K.
42	749	L	1961	2.7-290	3	Si-1	High purity; 0.2 x 0.4 x 2 cm; supplied by Texas Instruments Inc.; electrical resistivity ~~2,000~~ 2000 ohm cm at ~~max thermal conductivity~~ 0 C.
43	749	L	1961	3.1-106	3	Si-2	Similar to the above specimen but with more impurities; electrical resistivity 18 ohm cm at ~~max thermal conductivity~~ 0 C.
44	749	L	1961	3.6-290	3	Si-3	Similar to the above specimen but with more impurities; electrical resistivity 7.2 ohm cm at ~~max thermal conductivity~~ 0 C.
45	749	L	1961	5.8-210	3	Si-4	Similar to the above specimen but with more impurities; electrical resistivity 0.57 ohm cm at max thermal conductivity.
46	566	C	1956	313		Si	p-type; electrical resistivity 2 to 3 ohm cm at 293 K; Firth Brown F.H. steel used as comparative material.
47	750	P	1961	311-1018	2	Si-142	Solid specimen; electrical resistivity 100 ohm cm at ~~max thermal conductivity~~ room temperature; measured in vacuo; thermal conductivity values calculated from measured data of thermal diffusivity using specific heat data taken from Amer. Inst. Physics Handbook (McGraw Hill Book Co., New York, p. 4-42, 1957).
48	751		1963	84-285			Virgin specimen.
49	751		1963	78-250			Similar to the above specimen except irradiated with 1.2 x 10^{18} fast neutrons cm^{-2}.
50	752	P	1962	310-1220		Si-1142	Pure; intrinsic; single crystal; thermal conductivity values calculated from measured data of thermal diffusivity using specific heat data taken from Amer. Inst. Physics Handbook (McGraw Hill Book Co., New York, 1957).
51	899	L	1965	9.3-299		1	Prepared from high-purity vacuum-floating-zone single crystal p-type (residual boron) material obtained from Merck and Co.; 0.152 cm wide x 0.046 cm thick; long dimension in the <111> direction; electrical resistivity 5000 ohm cm, carrier concentration ~3 x 10^{12} cm^{-3}.
52	899	L	1965	47-59		1	The above specimen irradiated in <110> direction with a total time-integrated flux of 8.0 x 10^{18} 2-Mev e cm^{-2} on a length of 1.0 cm; annealed at 60 K for 15 min.
53	899	L	1965	9.5-76		1	The above specimen annealed again for 15 min at 77 K.
54	899	L	1965	9.3-132		1	The above specimen annealed again for 15 min at 135 K.
55	899	L	1965	9.1-146		1	The above specimen annealed again for 15 min at 150 K.
56	899	L	1965	9.1-176		1	The above specimen annealed again for 15 min at 180 K.
57	899	L	1965	8.8-227		1	The above specimen annealed again for 15 min at 230 K.

SPECIFICATION TABLE NO. 51 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
58	899	L	1965	9.7-172		1	The above specimen annealed again for 15 min at 280 K.
59	899	L	1965	9.4-300		1	The above specimen annealed again for 15 min at 410 K.
60	899	L	1965	8.6-303		2	Prepared from high-purity vacuum-floating-zone single crystal p-type (residual boron) material obtained from Merck and Co.; 0.153 cm wide x 0.048 cm thick; long dimension was the <111> direction; electrical resistivity 5000 ohm cm; carrier concentration ~3 x 10^{12} cm^{-3}.
61	899	L	1965	47-59		2	The above specimen irradiated in <110> direction with a total time-integrated flux of 8.0 x 10^{18} 2-Mev e cm^{-2} on a length of 1.0 cm; annealed at 60 K for 15 min.
62	899	L	1965	8.9-76		2	The above specimen annealed again for 15 min at 77 K.
63	899	L	1965	8.9-132		2	The above specimen annealed again for 15 min at 135 K.
64	899	L	1965	8.8-146		2	The above specimen annealed again for 15 min at 150 K.
65	899	L	1965	8.7-176		2	The above specimen annealed again for 15 min at 180 K.
66	899	L	1965	8.4-226		2	The above specimen annealed again for 15 min at 230 K.
67	899	L	1965	8.5-81		2	The above specimen annealed again for 15 min at 280 K.
68	899	L	1965	8.9-301		2	The above specimen annealed again for 15 min at 410 K.
69	339, 883	L	1965	5.4-285	10 in 4-20K and 100-300K; 15 in 20-100K		Phosphorus-doped n-type single crystal; 15 x 4 x 2 mm; long dimension in the <111> direction; obtained by floating zone technique; electrical resistivity 0.35 ohm cm.
70	339, 883, 988	L	1965	5.5-288	Same as above		Similar to the above specimen; irradiated at 30 C with a fast-neutron integrated flux 1.1 x 10^{15} n cm^{-2}.
71	339, 883	L	1965	4.9-277	Same as above		Similar to the above specimen; irradiated at 30 C with a fast-neutron integrated flux 2.5 x 10^{15} n cm^{-2}.
72	883	L	1965	5.5-173	Same as above		Similar to the above specimen; irradiated at 30 C with a fast-neutron integrated flux 1.7 x 10^{18} n cm^{-2}.
73	883	L	1965	5.2-286	Same as above		Similar to the above specimen; irradiated at 30 C with a fast-neutron integrated flux 3.4 x 10^{20} n cm^{-2}.
74	335	C	1965	567-1072		S-1	n-type single crystal; carrier concentration N_D = 5 x 10^{15} cm^{-3}; high purity silicon used as comparative material.
75	335	C	1965	596-1073		S-2	n-type single crystal; N_D 5 x 10^{15} cm^{-3}; Armco iron used as comparative material.
76	335	C	1965	98			n-type single crystal; supplied by Knapic Electro-Physics; 23 mm dia x 8 mm thick; circular cross-section perpendicular to <111> direction; N_D ~5 x 10^{15} cm^{-3}; Armco iron used as comparative material.
77	335	C	1965	179-256			2nd run of the above specimen.
78	335	C	1965	143, 217			3rd run of the above specimen.

SPECIFICATION TABLE NO. 51 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
79	901	C	1965	98-255	10		n-type single crystal; supplied by Knapic Electro-Physics; 23 mm dia x 8 mm thick; circular cross-section perpendicular to <111> direction; $N_D \sim 5 \times 10^{15}$ cm^{-3}; Armco iron used as comparative material.
80	902	C	1967	588-1276	20-25	Si-E4	0.1 P-doped; n-type single crystal; measured in a vacuum of 5×10^{-6} to 10^{-6} torr; Armco iron used as comparative material.

DATA TABLE NO. 51 THERMAL CONDUCTIVITY OF SILICON

(Impurity <0.20% each; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
1.75	0.0087*
1.83	0.0101*
2.37	0.0172*
2.83	0.0277*
3.40	0.0468*
4.40	0.0803*
6.65	0.175
7.41	0.265
9.24	0.478
11.23	0.720
14.30	1.168
17.30	1.595
21.60	2.290
25.30	2.810
28.90	3.330
34.20	4.070
44.80	5.120
62.00	5.270
78.00	5.270
90.60	5.225
100.00	5.060
CURVE 2	
1.91	0.186
2.13	0.274
2.44	0.356
2.91	0.575
3.44	0.898
4.29	1.60
6.99	4.41
7.65	5.03
7.81	5.30
9.02	6.62
12.0[illegible]	9.91
14.[illegible]	10.8
17.9	11.7
22.4	12.2
27.4	11.5
33.2	11.1
38.5	11.1
57.6	8.49

T	k
CURVE 2 (cont.)	
65.6	7.95
72.0	7.03
79.3	6.19
91.3	5.72
93.4	5.13
116.0	4.52
149.0	3.29
CURVE 3	
283.2	1.088
CURVE 4	
1.83	0.222
1.95	0.252
2.05	0.315
2.45	0.450
2.75	0.675
3.22	1.06
3.60	1.50
3.75	1.66
4.45	2.50
4.53	2.73
5.00	3.50
5.92	4.98
6.70	6.20
7.30	7.50
8.10	8.90
9.00	9.98
9.95	11.40
10.3	12.00
11.6	13.30
14.5	16.00
16.8	17.00
20.4	17.50
23.0	17.00
25.0	16.50
25.3	16.50
29.0	15.50
33.0	15.00
39.0	13.50

T	k
CURVE 4 (cont.)	
41.5	13.40
45.0	13.00
50.0	12.50
50.2	12.00
59.5	11.70
65.0	11.20
71.0	10.20
80.2	9.15
84.5	8.50
90.2	8.40
90.2	8.80
92.0	8.00
150.0	4.00
154.[illegible]	3.70
195.0	2.55
200.0	2.48
250.0	1.85
276.0	1.76
300.0	1.43
CURVE 5	
2.05	0.117
2.15	0.128
2.38	0.168
2.42	0.173
2.60	0.238
2.65	0.250
3.00	0.345
3.50	0.500
4.00	0.776
4.50	1.07
5.30	1.76
6.20	2.60
7.26	3.60
8.15	4.53
9.20	5.50
10.00	6.40
10.50	7.00
12.70	8.40
13.60	9.30
14.50	9.80

T	k
CURVE 5 (cont.)	
15.20	10.05
17.50	11.60
18.70	12.10
19.30	12.30
21.50	12.90
26.00	12.80
31.5	12.70
36.0	12.60
44.5	11.50
51.0	10.90
58.70	10.30
66.00	9.50
74.00	9.00
80.50	8.15
CURVE 6	
303.2	1.27
328.2	1.16
333.2	1.13*
373.2	0.975
435.2	0.778
459.2	0.761
523.2	0.653
579.2	0.561
CURVE 7	
328.2	1.13
406.2	0.933
410.2	0.837
508.2	0.661
533.2	0.632
CURVE 8	
767	0.48
846	0.35
CURVE 9	
769	0.46

T	k
CURVE 9 (cont.)	
834	0.38
989	0.35
CURVE 10	
756	0.45
785	0.41
804	0.41
848	0.35*
889	0.34
924	0.31*
924	0.30
962	0.31
997	0.31
CURVE 11	
687	0.56
826	0.39
CURVE 12	
679	0.52
778	0.44
CURVE 13	
857	0.42
906	0.34
CURVE 14	
748	0.48
CURVE 15	
669	0.63
746	0.56
776	0.42*
835	0.46
857	0.37
869	0.39

T	k
CURVE 15 (cont.)	
875	0.37
899	0.36
941	0.37
966	0.30
999	0.27
1002	0.32
CURVE 16	
588.2	0.741
627.2	0.694
641.2	0.735
662.2	0.680
676.2	0.613
741.2	0.529
798.2	0.459
883.2	0.398
982.2	0.333
1073.2	0.263
CURVE 17*	
593.2	0.621
781.2	0.417
883.2	0.377
CURVE 18	
334.2	1.111*
387.2	0.847
390.2	0.926
413.2	0.794
441.2	0.769*
473.2	0.840
CURVE 19	
3.5	0.200
4.9	0.395
5.5	0.505
7.0	0.950
7.5	1.30

T	k
CURVE 19 (cont.)	
8.5	1.30
9.2	1.90
12.0	3.65
14.0	5.50
16.0	6.75
18.0	8.00
20.0	9.50
23.0	10.00
29.0	12.50
31.0	12.00
40.0	13.2
50.0	13.2
55.0	14.5
63.0	13.6
80.0	11.0
99.5	10.02
111.0	8.50
120.0	8.00
126.0	7.00
140.0	5.50
145.0	4.50
149.0	5.00
170.0	3.50
199.5	3.70
199.5	3.00
210.0	3.00
CURVE 20	
2.63	0.85
3.50	1.70
4.10	2.65
5.00	4.50
6.00	6.50
6.50	9.50
8.00	16.0
8.10	13.6
10.00	17.0
15.0	28.0
18.0	26.5
20.0	30.0
21.0	25.5

*Not shown on plot

DATA TABLE NO. 51 (continued)

T	k
CURVE 20 (cont.)	
24.0	26.5
30.0	23.5
70.0	16.0
73.5	18.0
85.0	15.0
90.0	17.7
109.5	14.0
110.0	11.2
140.0	9.00
190.0	6.00
CURVE 21	
5.50	5.60
5.90	6.45
6.46	7.50
9.45	12.9
12.0	16.9
15.5	19.5
18.0	19.4
20.5	19.6
23.5	19.1
25.0	18.5
28.0	18.0
30.0	17.2
32.0	16.5
34.5	15.5
39.0	14.0
41.0	12.9
45.0	12.7
60.0	11.0
70.0	10.0
75.0	9.50
78.0	9.50
82.5	9.5
88.0	8.50
95.0	7.80
97.0	7.00
100.0	6.60
119.8	5.30
240.0	2.15
246.0	1.94
CURVE 22	
5.20	5.00
5.60	6.10

T	k
CURVE 22 (cont.)	
6.30	8.00
7.50	10.0
8.50	14.0
9.20	14.8
9.25	16.0
10.5	18.0
11.0	19.5
11.4	21.0
12.0	22.7
13.0	24.3
13.7	27.0
14.5	28.0
15.1	29.5
16.2	30.8
16.7	32.0
18.0	32.7
20.2	32.5
22.0	32.9
23.5	32.0
24.5	32.0
25.1	30.6
27.5	29.5
30.0	28.0
55.6	16.4
69.0	14.6
70.0	13.7
74.0	13.0
84.5	11.2
88.0	11.0
90.0	10.0
208.0	2.50
CURVE 23	
5.25	5.30
7.00	10.7
8.00	13.6
8.50	14.5
9.20	17.7
9.70	19.2
10.2	21.6
11.9	24.6
12.0	28.6
13.0	31.0
14.0	33.0
15.2	36.5
16.0	39.5

T	k
CURVE 23 (cont.)	
16.9	42.3
17.7	44.8
18.6	45.1
19.5	45.0
20.0	46.0
21.5	47.0
24.0	49.3
26.0	50.0
27.0	49.0
28.0	49.9
30.8	47.5
33.0	45.0
34.5	42.0
38.5	38.5
40.5	35.0
57.0	24.0
62.5	20.0
82.0	14.0
85.0	12.8
88.5	12.2
92.0	11.0
200.0	2.50
CURVE 24	
6.00	7.00
6.50	8.50
7.50	11.7
9.75	20.8
11.0	25.0
13.0	32.0
14.0	36.0
15.0	39.2
16.0	44.0
16.7	45.0
17.8	46.0
18.2	47.5
19.0	47.7
20.0	49.9
21.5	50.0
22.5	52.3
23.2	50.0
26.0	51.0
30.0	49.8
36.0	40.5
40.0	35.0
42.0	33.5

T	k
CURVE 24 (cont.)	
45.0	30.5
47.5	28.0
51.0	26.0
56.5	23.0
60.0	21.0
65.0	18.0
70.0	17.0
72.0	16.0
75.0	15.2
85.0	12.1
98.0	9.50
100.0	8.50
105.0	7.90
110.0	7.40
113.0	7.00
120.0	6.25
CURVE 25	
6.25	1.80
7.00	2.30
8.00	3.10
9.40	4.40
10.0	5.00
12.0	6.50
13.6	8.00
15.6	10.0
17.0	11.0
19.0	12.2
20.0	12.8
21.7	13.5
23.0	14.0
24.0	14.1
25.0	14.7
26.7	15.0
29.5	15.2
33.0	15.1
37.0	15.0
41.8	15.0
43.0	14.6
45.0	14.0
50.0	12.9
54.0	12.3
57.5	12.4
60.0	12.2
61.0	11.8
63.7	11.6

T	k
CURVE 25 (cont.)	
66.3	11.1
71.0	11.0
73.2	10.2*
81.5	9.50*
85.0	9.20
87.5	8.80*
90.0	8.50*
92.0	8.00*
97.0	7.50
100.0	7.25
107.0	6.50
118.0	5.65
123.0	5.00
150.0	2.55
200.0	2.42
220.0	2.27
225.0	2.15
242.0	1.93*
255.0	1.80
298.0	1.42*
CURVE 26	
5.20	2.10
5.30	2.40
5.80	3.40
6.80	4.10
8.00	5.60
9.00	7.65
10.0	9.80
11.0	11.6
12.8	15.4
14.0	18.3
14.8	21.0
16.0	24.0
17.0	28.0
18.0	29.5
18.7	32.5
20.0	35.5
21.0	37.0
23.0	39.5
25.0	41.0
27.5	41.5
28.5	43.0
32.0	42.0
34.5	39.0
39.0	35.0

T	k
CURVE 26 (cont.)	
55.0	26.5
59.6	24.0
70.0	18.9
75.0	17.0
80.0	15.4
85.0	14.0
90.0	12.3
99.7	10.5
112.0	7.50
150.0	4.50
250.0	2.20
275.0	1.80
CURVE 27	
5.90	4.95*
6.10	5.90
7.00	7.70
7.80	9.50
8.70	13.0*
9.20	15.0*
9.90	16.0
10.5	19.0
13.2	28.5
14.8	32.0
15.9	35.0
18.0	40.0
19.0	42.0
19.9	43.0
21.0	46.0
23.0	46.0
24.0	47.0
27.5	46.5
30.0	45.0
32.0	44.5
34.0	42.0*
35.0	40.0
37.0	38.0
40.5	34.5*
57.5	24.5
73.0	18.0*
80.0	16.3
82.5	15.0
87.5	13.0
95.0	11.0
106.0	9.00*
109.0	8.50*

T	k
CURVE 27 (cont.)	
116.0	7.50
119.0	7.00
120.0	6.70
148.5	4.75
240.0	2.30
265.0	2.00*
280.0	1.75*
290.0	1.64
299.5	1.50
CURVE 28	
300	1.42
350	1.22
375	1.08
400	0.97
420	0.94
445	0.82
470	0.76
495	0.72
520	0.66
545	0.64
565	0.63
590	0.59
620	0.55
670	0.53
695	0.50
720	0.47
745	0.45
770	0.43*
795	0.41*
825	0.40
850	0.36
CURVE 29	
775	0.41*
800	0.41*
830	0.40*
850	0.35*
880	0.34
900	0.33
925	0.34
950	0.33*
975	0.31*
995	0.31*
1010	0.31*

T	k
CURVE 29 (cont.)	
1030	0.30*
1050	0.30
1070	0.29*
1090	0.29*
1115	0.29*
1190	0.27*
1200	0.27
CURVE 30	
1115	0.30
1140	0.28*
1160	0.28*
1180	0.29
1190	0.30
1220	0.29*
1230	0.29*
1250	0.28
1270	0.28*
1320	0.27*
1340	0.27*
1360	0.27
1370	0.28
CURVE 31	
4.26	2.12
5.29	4.12
7.53	7.96
10.59	15.99
14.14	23.93
15.43	26.68
17.48	31.04
17.69	29.35
18.16	26.37
19.23	35.78
25.60	34.67
32.36	36.14
43.25	30.02
66.89	18.19
93.21	10.65
138.47	5.00
199.36	2.72
200.18	2.66*
299.10	1.56*
299.15	1.59*
299.80	1.56*
304.04	1.54*

* Not shown on plot

DATA TABLE NO. 51 (continued)

T	k
CURVE 32	
417.6	0.986
493.1	0.815
567.1	0.694
633.8	0.596
645.2	0.559
676.9	0.506*
707.1	0.529
722.1	0.500
731.6	0.487
766.1	0.460*
780.2	0.452*
808.9	0.421
851.2	0.378*
858.0	0.382*
916.0	0.348*
941.8	0.318
957.9	0.334*
963.3	0.324*
1035.4	0.300*
1076.1	0.269*
1102.6	0.287*
1174.2	0.266
1182.2	0.259
1184.7	0.269*
1229.4	0.249
1269.3	0.256
1275.0	0.257*
1375.3	0.238
1474.8	0.247
1576.9	0.223
1577.0	0.218
CURVE 33	
578	0.678
520	0.736
483	0.770
420	0.895
371	0.992
320	1.216
CURVE 34*	
495	0.724
434	0.812
404	0.879

T	k
CURVE 34 (cont.)*	
349	1.017
330	1.197
300	1.305
CURVE 35*	
404	0.929
302	1.343
CURVE 36*	
467	0.787
409	0.875
380	0.950
362	1.067
333	1.209
302	1.205
CURVE 37*	
694	0.481
613	0.557
561	0.628
487	0.724
460	0.770
414	0.824
389	0.845
371	0.962
336	1.050
CURVE 38	
10	0.01*
25	0.06*
30	0.09*
31	0.105
36	0.14*
41	0.18
50	0.25
66	0.32
90	0.38
200	0.42
300	0.40
320	0.397

T	k
CURVE 39	
2.1	0.00108*
2.75	0.00145*
4.25	0.0025*
5.3	0.0035*
6.4	0.0045*
6.6	0.0050*
7.0	0.0054*
10.05	0.0115*
14.0	0.02*
17.5	0.033*
22.0	0.064*
33.0	0.16
35.0	0.19
50.0	0.32
55.0	0.38
62.0	0.43
70.0	0.49
85.0	0.50
90.0	0.53
105	0.55
145	0.52
200	0.53
250	0.49
300	0.47
CURVE 40	
3.2	0.006*
4.3	0.0095*
5.5	0.0155*
6.5	0.023*
11.0	0.075*
15.5	0.248*
25	0.8*
27	0.9
35	1.85
75	3.75
93	3.6
206	1.6
300	1.2
340	1.05
CURVE 41	
3.8	0.003*
5.2	0.00475*

T	k
CURVE 41 (cont.)	
7.4	0.0085*
10.5	0.0175*
12.5	0.025*
14	0.030*
20	0.080*
25	0.13
30	0.24
37	0.35
70	1.0
85	1.18
145	1.23
190	1.02
300	0.75
CURVE 42	
2.7	0.85
3.6	1.59
4.3	2.65
5.3	4.40
6.0	6.70
6.7	9.20
8.0	12.5
7.8	16.0
9.9	17.2*
14.5	27.9*
18.2	28.0
20.1	28.0
21	27.0
23	26.9
30	24.0
70	16.9*
73	18.0*
83	16.0
85	17.1
100	14.0
110	11.5
135	8.0
177	5.5
250	3.3
290	2.9
CURVE 43*	
3.08	108
3.32	1.19

T	k
CURVE 43 (cont.)*	
3.56	1.28
4.50	2.4
4.8	3.18
5.2	4.15
7.0	7.5
9.5	11.0
15.5	16.9
22	17.8
28	18.0
39	16.5
62	12.1
97	7.0
100	7.6
106	7.5
CURVE 44*	
3.6	0.2
4.9	0.39
5.5	0.52
7.0	0.94
7.5	1.28
8.0	1.279
9.0	1.90
12.0	3.55
14.0	5.49
15.5	6.65
17.5	7.7
20	9.4
22	9.5
27	12.9
31.5	12.5
39.5	14.0
48	14.0
55	14.5
64	13.9
82	11.5
95	10.5
102	8.5
110	7.6
111	7.3
119	7.29
130	5.2
131	5.6
138	5.4
142	4.55

T	k
CURVE 44 (cont.)	
172	3.55
180	3.70
190	3.10
199	3.15
230	2.6
275	2.1
290	2.06
CURVE 45	
5.8	0.125
6.7	0.204
7.3	0.248
8.2	0.400
10.1	0.88
12.9	1.7
16.0	3.4
21	6.5
25	6.5
32	8.5
42	9.7
62	9.4
64	9.8
96	7.3
101	6.5*
104	6.3
110	5.9
152	3.6
163	3.45
170	3.25
172	3.08
210	2.4
CURVE 46	
313.2	1.29
CURVE 47*	
311	1.351
336	1.204
358	1.111
403	0.970
438	0.884
447	0.877
471	0.813

T	k
CURVE 47 (cont.)*	
490	0.775
543	0.690
603	0.633
615	0.602
723	0.515
818	0.410
918	0.346
1018	0.306
CURVE 48*	
84	12.0
90	11.1
96	10.0
100	9.50
108	8.50
120	6.50
136	5.30
160	4.20
190	3.20
230	2.30
285	1.62
CURVE 49	
78	2.92
83	2.92
94	2.80
98	2.70
100	2.75
108	2.66
112	2.60
115	2.60
140	2.03
170	1.70
210	1.44
225	1.30
240	1.23
250	1.24
CURVE 50*	
310	1.318
336	1.192
357	1.109
400	0.962

T	k
CURVE 50 (cont.)*	
439	0.877
465	0.819
465	0.796
489	0.774
503	0.751
541	0.685
613	0.598
725	0.511
833	0.397
893	0.383
925	0.340
1010	0.327
1042	0.295
1136	0.282
1220	0.264
CURVE 51	
9.27	4.84
9.38	5.21
9.62	4.93
11.9	7.19
13.0	8.65
14.0	10.8
15.0	11.7
15.1	10.7*
16.1	11.3
16.9	14.1
19.0	15.3
22.1	19.1
24.1	19.8
24.1	18.3*
28.3	17.7*
29.1	19.0
30.1	19.0
32.3	21.6
34.4	19.8
36.2	22.5
38.2	19.8
42.5	21.6
47.5	18.2
49.2	18.3
49.2	17.8*
56.1	15.9
65.3	14.1
70.5	13.1

* Not shown on plot

DATA TABLE NO. 51 (continued)

CURVE 51 (cont.)

T	k
77.3	11.7
80.4	10.5
85.1	10.3
90.0	9.18
95.1	8.79
100.7	7.94
109.7	6.64
120.8	5.75*
130.6	4.99*
140.3	4.40*
151.0	3.96*
161.8	3.65*
171.0	3.22*
181.2	3.06*
191.5	2.88*
201.0	2.66*
216.3	2.39*
231.8	2.24*
250.7	2.03*
276.8	1.86*
299.3	1.72*

CURVE 52

T	k
47.2	5.40
47.2	5.53
49.7	5.53
51.5	5.42
53.3	5.55
55.6	5.68
57.4	5.52
59.3	5.62

CURVE 53

T	k
9.51	2.20
9.66	2.25
10.1	2.23
10.8	2.44
12.0	2.84
13.1	2.96
14.0	3.05
14.9	3.18
16.1	3.46*
16.9	3.57
18.0	3.74
19.1	3.84

CURVE 53 (cont.)

T	k
20.0	3.54
22.1	4.17
28.2	4.65
30.4	4.84
32.2	4.57
34.3	4.81
36.2	5.19
38.3	4.98
40.3	5.25
42.3	5.07
44.4	5.16*
46.6	5.56*
49.4	5.43*
53.3	5.46*
55.6	5.46*
57.4	5.73
50.4	5.81
65.3	5.81
68.1	5.56
70.2	5.68
73.5	5.85
75.5	5.70

CURVE 54

T	k
9.33	2.00
9.46	2.02*
10.0	2.05
11.0	2.41
12.0	2.56*
13.1	2.86
14.1	3.01*
15.1	3.13*
16.1	3.50
16.2	3.72
17.2	3.96
18.1	3.83*
19.1	4.04
20.0	4.06
22.1	4.04
24.2	4.45
25.2	4.56
28.1	4.84
30.1	5.04
32.2	4.97
34.1	5.32
36.3	5.53

CURVE 54 (cont.)

T	k
38.3	5.53
40.2	5.82
42.3	5.73
44.3	6.15
46.8	6.10
46.8	6.24
48.4	6.44
50.4	6.07
52.4	6.00
55.5	6.53
58.1	6.46
60.3	6.28
65.6	6.43
68.9	6.07
72.0	6.41
75.2	6.15
80.0	5.81
85.1	5.74
90.2	5.53
95.1	5.46
100.3	5.33
109.9	4.89
120.5	4.36
131.9	3.92

CURVE 55

T	k
9.14	2.66
9.29	2.74
10.0	2.83
11.0	3.16
12.1	3.57
13.0	3.87
14.1	4.06
15.0	4.35
16.0	4.66
17.0	5.01
19.0	5.46
19.0	5.64
20.1	5.64
20.9	5.42
22.1	5.37
22.4	5.70
24.1	5.89
26.1	5.55
26.1	5.83

CURVE 55 (cont.)

T	k
28.2	6.04
30.1	6.40
32.3	6.31
34.1	6.70
36.2	6.80
38.2	7.13
40.5	7.05
43.2	7.15
47.2	7.00
47.8	7.30
50.4	7.19
50.4	7.02*
52.4	7.05
55.4	7.31
58.0	7.36
60.6	7.13
65.3	7.36
68.6	7.06
70.7	7.28*
75.9	6.84
80.4	6.43
85.5	6.18
90.4	6.12
95.7	5.86
100.5	5.64
120.5	4.55
131.2	4.00*
145.6	3.55

CURVE 56

T	k
9.12	2.91
9.42	3.03
10.0	3.17
11.0	3.74
11.7	4.38
13.2	4.67
14.1	5.22
14.9	5.32
16.1	5.56
17.1	6.00
18.0	6.55
19.1	6.84
20.1	7.06
22.0	6.55
22.7	6.55
24.1	6.95

CURVE 56 (cont.)

T	k
26.1	7.48
28.1	7.35
30.1	7.85
32.1	7.08
32.1	7.23
34.4	7.82
36.2	8.00
38.2	8.00
40.3	7.94
42.1	7.98
44.3	8.15
48.1	8.32
48.1	8.51
50.5	8.63
53.2	8.26
55.4	8.55
58.0	8.41*
60.3	8.59
65.5	8.32
70.5	8.09
80.7	7.35
85.7	6.73
90.8	6.55
95.7	6.32
100.5	5.83
110.2	5.16
121.1	4.76
129.1	4.28
141.3	3.57*
160.4	3.07*
176.2	2.88*

CURVE 57

T	k
8.81	3.34
9.00	3.42
10.0	3.81
11.0	4.17
11.0	4.26*
12.0	5.18
13.0	5.75
14.1	6.28
15.1	6.65
16.0	7.46
17.0	7.28
18.0	7.93*
19.0	8.81
19.0	9.48

CURVE 57 (cont.)

T	k
20.1	9.23
21.0	8.67
22.2	8.83
24.1	8.28
26.1	9.14
28.1	9.14
30.1	9.27
30.4	8.73
30.4	9.29*
32.1	8.85
34.1	9.10
36.2	9.02
38.3	9.25
40.4	9.33
47.5	9.53
50.5	9.38
53.0	9.53
55.4	9.35
58.0	9.42
60.4	9.62
65.6	9.04
70.7	8.77
75.7	8.07
80.4	7.66
85.3	7.02
90.1	7.02
95.7	6.71
101.2	6.35
110.4	5.66
120.8	4.89*
131.2	4.42*
151.0	3.50*
166.8	3.16*
180.8	2.84*
201.4	2.31*
227.0	2.12*

CURVE 58

T	k
9.66	4.06
10.1	4.68
11.0	4.84
12.0	5.88
13.0	7.05
14.0	7.98
15.0	8.43
16.0	8.71

CURVE 58 (cont.)

T	k
17.0	9.04
18.0	9.04
19.0	9.44*
20.0	10.8
21.6	10.0
23.0	10.9
24.0	11.8
26.1	10.8
28.1	11.9
30.1	11.0
30.1	10.7*
32.2	10.6
34.1	11.4
36.1	11.0
37.9	11.7
40.0	11.4
42.0	12.0
44.0	12.0
46.3	12.2
48.4	11.8
50.1	11.5
52.6	11.3
55.5	10.9
58.0	10.7
60.6	10.9*
65.6	10.3
70.7	9.86*
75.9	9.62*
80.9	8.38*
139.7	4.19*
171.8	3.13*

CURVE 59*

T	k
9.42	4.97
10.0	5.93
11.0	7.16
12.0	7.78
12.0	8.75
13.0	9.23
14.0	9.66
15.0	11.0
15.9	11.4
17.0	13.3
17.0	14.6
17.0	14.9
18.0	14.7

*Not shown on plot

DATA TABLE NO. 51 (continued)

T	k
CURVE 59 (cont.)*	
19.0	14.7
19.0	15.9
19.9	13.9
22.0	14.6
26.0	13.6
28.1	14.7
30.1	13.3
32.1	12.9
34.1	12.9
36.0	13.2
38.1	13.3
40.1	13.8
42.1	13.0
44.1	13.1
46.0	13.2
48.2	12.4
50.1	12.0
53.2	11.8
53.2	12.4
56.4	13.0
57.8	12.4
60.4	12.8
64.1	12.3
67.3	11.7
67.3	11.3
70.2	10.8
71.8	11.0
75.5	10.0
79.6	10.0
85.5	9.20
85.5	8.67
90.6	7.91
95.7	7.30
100.3	6.93
105.2	6.38
110.9	6.38
121.1	5.45
141.0	4.30
171.0	3.14
201.4	2.47
251.2	1.92
300.0	1.65
CURVE 60	
8.61	4.72
10.5	7.02*

T	k
CURVE 60 (cont.)	
11.4	8.19
12.7	10.6
13.8	11.9
14.2	13.8
14.6	14.7
16.8	17.1*
18.2	19.1*
21.0	18.3
25.1	19.1
25.9	20.9
27.5	23.2
27.9	22.1
29.1	22.1
33.0	24.6
35.7	26.1
37.3	27.4
38.5	24.7
41.5	26.0
43.6	24.6
44.3	25.9
45.7	24.8
47.1	24.8*
48.2	24.8
50.4	24.8
51.7	23.4
54.0	22.2
57.6	20.3
61.7	19.3
66.4	17.7*
71.8	15.3
77.6	13.4
81.7	12.7
86.1	11.6*
91.0	10.8*
100.9	8.53*
110.2	7.35*
120.8	6.05*
130.9	5.21*
141.9	4.54*
151.4	4.10*
160.7	3.77*
171.8	3.40*
181.6	3.12*
202.3	2.68*
217.3	2.42*
235.0	2.25*
251.8	2.09*

T	k
CURVE 60 (cont.)	
276.1	1.97*
302.8	1.71*
CURVE 61*	
46.9	6.01
49.9	6.14
51.4	5.86
53.6	5.93
55.7	5.90
57.6	5.94
58.6	5.85
CURVE 62*	
8.94	2.02
9.02	1.98
9.98	2.16
10.9	2.32
11.9	2.71
12.8	2.80
14.0	2.97
14.9	3.24
16.0	3.57
17.0	3.68
18.1	3.82
19.1	4.21
20.1	4.06
22.0	4.35
23.9	4.47
26.0	4.55
27.9	4.68
30.0	5.00
32.2	5.41
34.1	5.28
36.1	5.40
38.2	5.72
40.0	5.72
42.0	5.94
44.2	5.73
46.4	5.74
49.1	6.11
51.4	6.05
53.1	5.94
55.0	6.24
57.6	6.14
60.4	6.22

T	k
CURVE 62 (cont.)*	
53.4	6.14
65.3	6.05
68.1	5.92
70.3	6.14
75.5	5.88
CURVE 63	
8.89	1.80*
8.94	1.79
9.96	1.95
11.1	2.29
12.0	2.59*
13.1	2.75
14.1	2.83
15.0	3.15*
16.1	3.68*
17.1	3.66*
18.1	4.06
19.0	4.34
20.0	4.23
22.1	4.56
24.1	5.04
26.0	4.82
28.1	5.20
30.3	5.14
32.1	5.72
34.1	5.94
36.1	5.85
38.0	5.93
40.3	6.05
42.2	6.46
44.2	6.46
46.5	6.52
48.3	6.52*
50.2	6.47
52.4	6.35
55.1	6.55*
57.7	6.73
60.3	6.98
65.6	6.65
68.7	6.55
72.0	6.43*
75.4	6.59
80.6	6.22*
85.7	5.98*
90.4	5.93*

T	k
CURVE 63 (cont.)	
95.7	5.65*
100.7	5.65*
111.7	5.00*
121.4	4.36*
131.9	4.04*
CURVE 64*	
8.75	2.50
8.75	2.55
8.81	2.64
9.96	2.79
11.0	3.09
12.0	3.45
13.0	3.85
14.0	4.35
15.0	4.74
16.0	5.22
17.1	5.02
18.1	4.93
18.1	[illegible]
19.1	5.30
20.0	5.74
22.1	6.53
24.1	6.53
26.0	6.82
28.0	6.65
30.1	6.90
32.1	7.43
34.2	6.97
36.1	7.69
38.2	6.93
40.1	7.87
43.1	7.94
47.7	8.24
50.1	7.66
52.7	7.91
55.0	7.66
57.4	7.66
57.8	8.34
60.7	7.94
65.3	7.91
68.4	7.83
70.3	7.76
75.2	6.82
80.4	6.95
85.5	6.87

T	k
CURVE 64 (cont.)*	
90.4	6.61
95.3	6.04
100.5	5.89
110.7	5.30
121.4	4.65
131.2	4.10
146.0	3.59
CURVE 65*	
8.67	2.83
9.98	3.16
11.0	3.72
11.8	4.44
13.0	4.65
14.0	4.67
15.0	5.36
16.0	5.33
17.1	6.03
18.1	6.34
19.6	6.78
20.1	6.52
22.0	7.10
24.0	7.94
26.0	8.75
28.1	8.91
32.0	8.59
34.1	9.18
36.2	9.44
38.2	9.27
40.2	9.51
42.5	10.2
44.4	9.57
48.2	9.93
50.4	9.42
52.9	9.84
55.2	9.62
57.7	9.12
60.4	9.48
65.6	8.89
70.2	9.14
75.5	9.04
80.4	8.36
85.5	7.89
90.4	7.13
95.3	6.58
101.4	6.03

T	k
CURVE 65 (cont.)*	
111.2	5.27
121.1	4.83
131.9	4.28
141.6	3.89
160.7	3.24
175.8	2.87
CURVE 66*	
8.40	2.74
8.44	2.83
9.96	3.85
11.1	4.85
12.0	5.16
13.0	5.83
14.1	5.72
15.1	6.41
16.0	6.86
17.0	7.43
17.9	7.23
18.3	7.31
19.1	7.31
19.6	7.15
20.1	7.96
20.1	8.40
21.3	9.18
22.1	8.91
22.2	10.8
22.7	10.3
24.1	10.6
26.2	10.4
28.1	9.89
30.4	10.8
32.3	10.4
34.4	10.6
36.2	10.6
38.3	10.6
40.2	11.4
46.9	11.6
47.9	11.6
50.9	11.3
53.0	11.9
55.5	11.6
58.0	10.9
60.7	11.1
65.9	10.5
70.7	9.55

*Not shown on plot

DATA TABLE NO. 51 (continued)

T	k
CURVE 66 (cont.)*	
75.5	9.51
80.2	9.16
85.3	8.11
90.2	7.73
95.7	6.87
100.9	6.71
110.9	5.75
120.8	5.21
131.9	4.19
151.4	3.55
166.4	3.06
181.2	2.84
202.3	2.34
226.0	2.10
CURVE 67*	
8.46	3.84
9.08	4.19
10.0	4.33
11.0	5.25
12.0	5.83
13.1	6.59
14.1	7.10
15.0	7.82
16.1	8.79
17.2	10.9
17.2	11.2
18.1	11.0
18.5	11.5
19.1	9.95
20.2	10.6
22.3	12.7
24.3	12.6
26.3	13.1
30.3	13.2
32.4	12.7
34.6	13.6
36.3	13.6
38.6	13.6
40.4	13.6
42.4	14.2
46.1	14.2
46.1	13.9
48.7	14.6
50.7	13.5
53.1	13.7

T	k
CURVE 67 (cont.)*	
55.6	13.3
58.0	12.4
60.7	12.0
65.9	11.4
70.8	10.7
75.7	9.86
80.7	9.62
CURVE 68*	
8.89	4.84
9.96	5.08
11.0	6.31
12.0	6.62
13.0	8.87
14.2	10.3
15.1	9.14
16.0	9.33
18.2	12.0
20.1	13.7
22.1	16.2
24.1	16.0
26.1	16.2
28.1	16.5
30.2	16.6
32.3	17.1
34.3	16.9
36.3	14.4
38.3	15.1
39.5	15.9
40.7	15.9
42.4	16.3
46.4	16.0
48.4	15.4
50.4	15.6
53.5	15.2
55.2	14.8
56.1	14.0
58.2	13.6
60.7	12.4
64.3	13.0
67.5	12.1
71.0	11.8
76.2	10.6
80.9	11.0
85.5	9.44
90.2	8.85

T	k
CURVE 68 (cont.)*	
95.5	8.04
100.5	7.40
111.5	6.24
120.5	5.35
141.0	4.14
171.8	3.16
201.4	2.52
253.0	2.00
300.7	1.70
CURVE 69	
5.40	2.99
6.25	4.49
9.08	10.9
9.98	12.8
12.3	17.4
15.4	26.8*
22.4	34.2
29.8	36.1
31.3	32.6
44.3	26.7
57.8	20.9*
75.0	13.7*
99.8	9.14*
121.4	6.07*
175.8	3.10*
222.4	2.23*
285.1	1.66*
CURVE 70*	
5.50	2.12
6.15	2.36
6.55	2.52
6.95	2.84
7.78	3.27
8.36	3.79
8.59	3.64
10.4	4.16
10.9	4.91
13.2	5.70
14.4	6.34
17.4	7.19
17.8	7.66
19.0	7.91
20.0	8.63

T	k
CURVE 70 (cont.)*	
22.1	8.32
23.3	8.41
26.2	9.12
29.9	8.89
33.8	8.49
39.5	7.93
42.5	8.04
49.9	7.78
76.2	6.35
82.2	5.86
97.5	5.14
128.8	3.36
164.5	2.75
225.5	1.83
288.4	1.39
CURVE 71	
4.87	1.26
5.56	1.45
6.55	1.71
6.68	1.85
6.92	1.97
9.14	2.62*
10.0	2.84*
10.0	2.94
11.4	3.21*
13.5	3.78
15.9	4.12
17.0	4.12
17.1	4.39
19.9	4.59
22.6	5.00
23.8	5.07*
24.3	4.79
26.3	4.79*
27.4	5.07*
31.7	4.91*
34.0	5.00
38.3	4.89
39.9	4.94
41.3	4.72
43.5	4.52
46.0	4.60
49.0	4.60
58.6	4.97
97.7	3.48

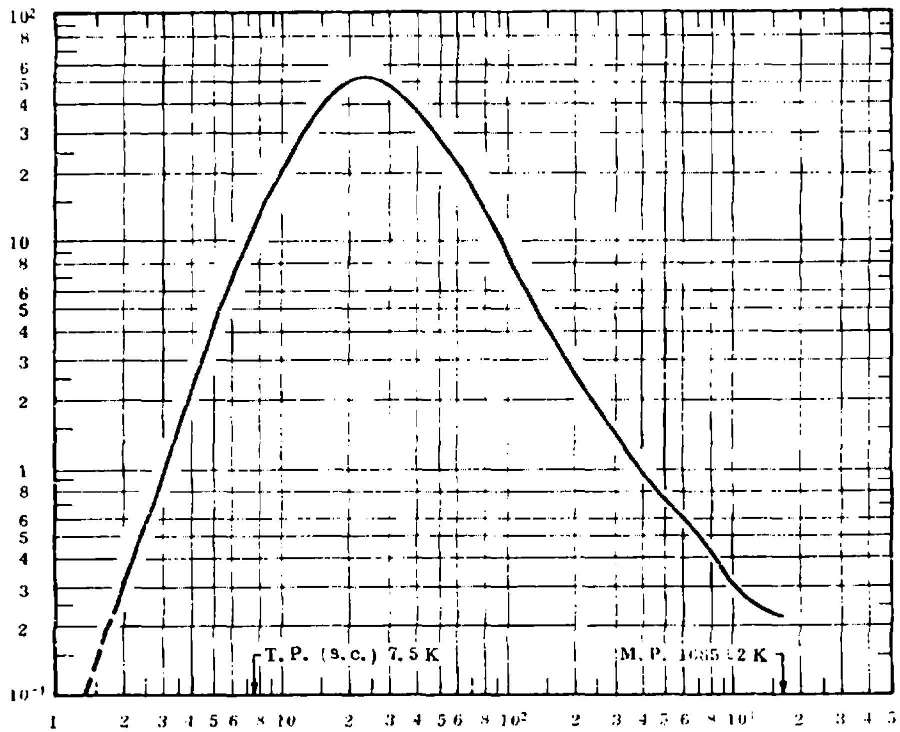
T	k
CURVE 71 (cont.)	
137.4	2.55
171.4	2.05
221.3	1.55
277.4	1.27
CURVE 72	
5.20	0.604
5.70	0.687
6.08	0.733
6.53	0.771
8.30	0.986
9.51	1.14
10.7	1.24
11.4	1.29
12.8	1.39
17.7	1.64
19.6	1.77
25.5	1.89
34.2	1.83
39.9	1.82
46.5	1.75
58.9	1.77
71.8	1.65
92.6	1.43
105.4	1.40
138.4	1.11
177.8	0.991
285.8	0.796
CURVE 73	
5.48	0.454
5.80	0.477
5.97	0.502
7.31	0.652
8.19	0.725
8.69	0.738
9.91	0.863
11.3	0.879
13.0	0.962
14.3	0.993
17.6	1.09
19.4	1.11
22.6	1.16
26.1	1.06
40.4	1.15
49.2	1.09

T	k
CURVE 73 (cont.)	
83.0	0.971
91.0	1.03
172.6	0.849
CURVE 74*	
567	1.20
722	0.452
871	0.583
1072	0.280
CURVE 75	
596	0.219
727	0.163
872	0.178
1073	0.162
CURVE 76*	
97.8	8.80
CURVE 77*	
178.5	3.19
218.3	1.60
240.4	1.45
256.3	1.66
CURVE 78*	
142.9	4.60
217.0	1.80
CURVE 79*	
98	8.68
142	4.63
178	3.19
217	1.91
217	1.65
240	1.56
255	1.80
CURVE 80	
588	0.22

T	k
CURVE 80 (cont.)	
719	0.17
729	0.16
742	0.18
853	0.22
873	0.21
873	0.18
1071	0.18*
1073	0.18
1078	0.16
1276	0.15

* Not shown on plot

FIGURE AND TABLE NO. 51R RECOMMENDED THERMAL CONDUCTIVITY OF SILICON



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.762	44.0	440.3
1	(0.0448)‡	(2.59)	-457.9	600	0.619	35.8	620.3
2	0.317	18.2	-456.1	700	0.508	29.4	800.3
3	0.998	57.7	-454.3	800	0.422	24.4	980.3
4	2.26	131	-452.5	900	0.359	20.7	1160
5	4.24	245	-450.7	1000	0.312	18.0	1340
6	6.86	396	-448.9	1100	0.279	16.1	1520
7	9.91	573	-447.1	1200	0.257	14.8	1700
8	13.4	774	-445.3	1300	0.244	14.1	1880
9	17.2	994	-443.5	1400	0.235	13.6	2060
10	21.1	1220	-441.7	1500	0.227	13.1	2240
11	24.8	1430	-439.9	1600	0.221	12.8	2420
12	28.7	1660	-438.1	1685	0.220	12.7	2573
13	32.5	1880	-436.3				
14	36.0	2080	-434.5				
15	39.3	2270	-432.7				
16	42.2	2440	-430.9				
18	46.7	2700	-427.3				
20	49.4	2850	-423.7				
25	51.4	2970	-414.7				
30	48.1	2780	-405.7				
35	41.3	2390	-396.7				
40	35.3	2040	-387.7				
45	30.6	1770	-378.7				
50	26.8	1550	-369.7				
60	21.1	1220	-351.7				
70	16.8	971	-333.7				
80	13.4	774	-315.7				
90	10.8	624	-297.7				
100	8.84	511	-279.7				
150	4.09	236	-189.7				
200	2.64	153	-99.7				
250	[illegible]	110	-9.7				
273.2	1.68	97.1	32.0				
300	1.48	85.5	80.3				
350	1.19	68.8	170.3				
400	0.989	57.1	260.3				

REMARKS

The recommended values are for high-purity silicon. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 4% of the true values at room and moderate temperatures and 4 to 10% at other temperatures above 50 K. The thermal conductivity near and below the corresponding temperature of its maximum is highly sensitive to small physical and chemical variations of the specimens, and the values below 50 K are intended as typical values for indicating the general trend.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}m T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

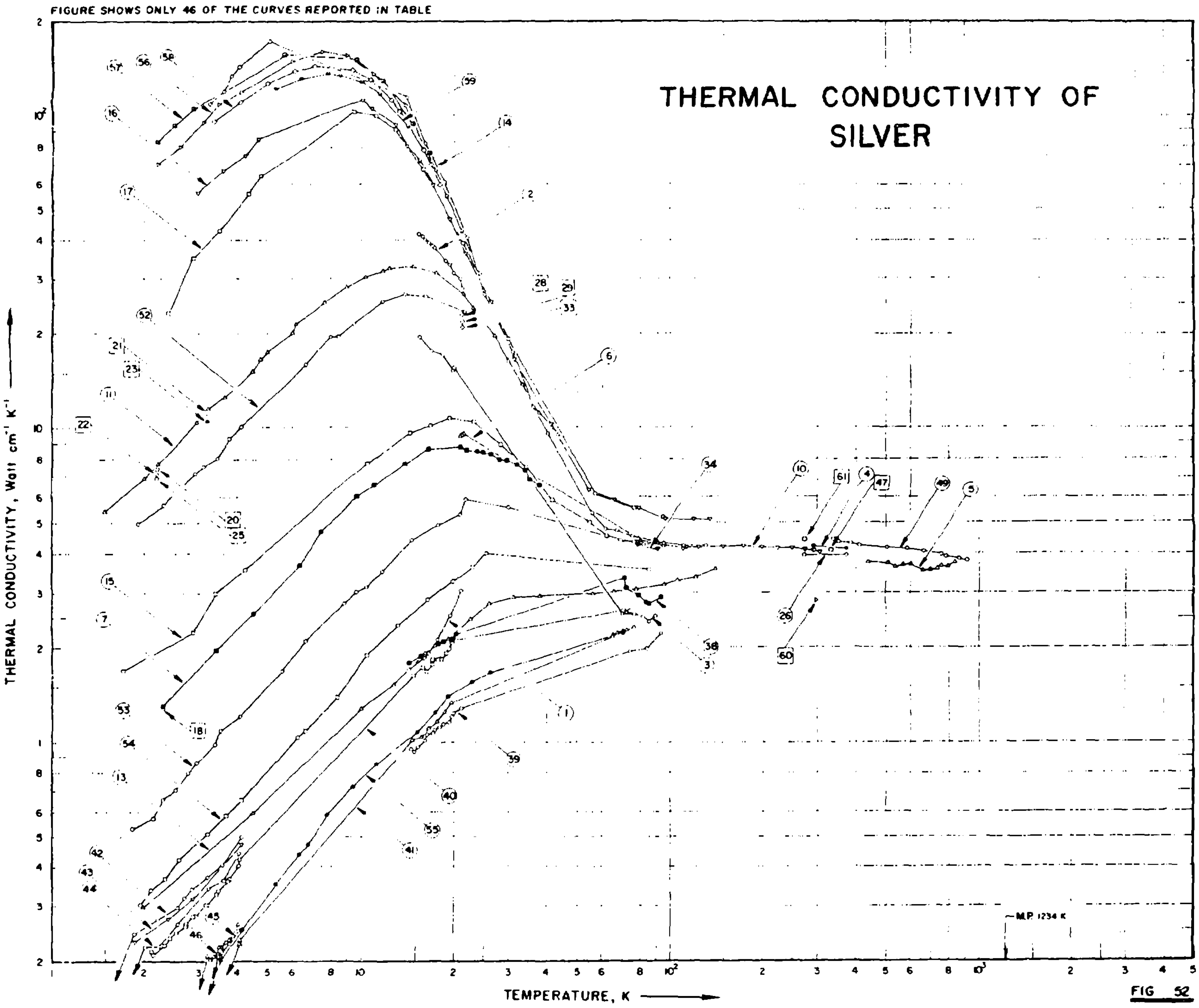


FIGURE SHOWS ONLY 46 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF SILVER
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 1234 K

FIG 52

SPECIFICATION TABLE NO. 52 THERMAL CONDUCTIVITY OF SILVER

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 52]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	51	L	1956	14-21		Ag 2	Commercially pure; supplied by Nordiska Affiveriet, Halsingborg; cold-worked; electrical resistivity ratio $\rho(273K)/\rho_0 = 38.4$.
2	51	L	1956	15-21		Ag 2t	The above specimen etched and annealed at 740 K; electrical resistivity reported as 0.00447, 0.00519, 0.00619, 0.00743, 0.238, 0.297, 0.359, and 1.47 μohm cm at 14, 16, 18, 20, 70, 80, 90, and 273 K, respectively; electrical resistivity ratio $\rho(273K)/\rho_0 = 417$.
3	51	L	1956	16-90		Ag 4t	Similar to the above specimen but annealed at 750 K; electrical resistivity reported as 0.00694, 0.00758, 0.00852, 0.00983, 0.235, 0.299, 0.363, and 1.48 μohm cm at 14, 16, 18, 20, 70, 80, 90, and 273 K, respectively; electrical resistivity ratio $\rho(273K)/\rho_0 = 250$.
4	77	E	1900	291, 373			99.98 pure; 1.1086 cm dia x 25.2 cm long; density 10.53 g cm^{-3} at 18 C; electrical conductivity reported as 61.4 and 46.9 x 10^4 ohm^{-1} cm^{-1} at 18 and 100 C, respectively.
5	6	L	1931	437-838			99.9 pure; 0.585 cm dia x 7-8 cm long; melting point 961 C.
6	58	L	1934	21-91		Ag 1	Pure; cold-worked and annealed at 350 C for 2 hrs.
7	97, 122	L	1952	2.3-38	2-3	JM 1722; Ag 1	99.99 pure; polycrystalline wire; 1.22 mm dia x 2.85 cm long; supplied by Johnson Matthey; $\rho(273K)/\rho(20K) = 30.9$.
8	78	E	1931	283-291	2	Ag 1	Commercially pure electrolytic silver; 0.05286 cm dia x 8.82 cm long; electrical conductivity 64.6 x 10^4 ohm^{-1} cm^{-1} at 273 K; Lorenz function 2.32 x 10^{-8} V^2 K^{-2} at 273 K.
9	78	E	1931	278-284	2	Ag II	Spectroscopically pure; 0.05059 cm dia x 8.74 cm long; electrical conductivity 61.2 x 10^4 ohm^{-1} cm^{-1} at 273 K; Lorenz function 2.41 x 10^{-8} V^2 K^{-2} at 273 K.
10	88	L	1908	110-306			99.9 pure; 0.585 cm dia x 7-8 cm long; density 10.47 g cm^{-3} at 21 C; electrical resistivity reported as 0.460, 0.470, 0.456, 0.609, 0.660, 0.693, 0.880, 0.923, 0.942, 1.236, 1.239, 1.245, 1.468, 1.471, 1.675, and 1.684 μohm cm at -178.3, -177.7, -176.1, -151.2, -144.9, -139.2, -109.0, -102.5, -98.6, -54.9, -52.8, -50.6, -13.0, -12.0, -21.0, and 21.8 C, respectively.
11	122	L	1955	1.5-44	3	JM 3351; Ag 2	99.99+ pure; polycrystalline; 1.33 mm dia x 2.8 cm long; supplied by Johnson Matthey; prepared from a 5 mm rod by rolling and drawing; annealed in vacuo at 750 C for several hrs.
12	79	E	1933	90-373			Traces of Bi, Cd, Cu, Pb, Mg, Si, and Na; 0.06095 cm dia x 9.770 cm long; drawn from a rod of H.S. brand silver supplied by A. Hilger, Ltd.; annealed at 500 C; electrical resistivity reported as 0.341, 1.035, 1.510, 2.123, and 2.863 μohm cm at -183.00, -78.50, 0, 100, and 217.96 C, respectively; measured in a vacuum of 10^{-4} mm Hg.
13	147	L	1953	2.0-140	1-3	JM 4606; Ag 1	99.999+ pure; polycrystalline; 2 mm dia rod supplied by Johnson Matthey.
14	147	L	1953	3.3-131	1-3	JM 4606; Ag 2	The above specimen annealed at 650 C; grain size ~0.1 mm.

SPECIFICATION TABLE NO. 52 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
15	147	L	1953	1.7-134	1-3	JM 4606; Ag 3	1.16 mm dia rod drawn from the above specimen.
16	147	L	1953	3.0-135	1-3	JM 4606; Ag 4	The above specimen annealed at 650 C.
17	147	L	1953	2.4-95	1-3	JM 4606; Ag 5	The above specimen, Ag 4, after being removed and replaced in cryostat.
18	342	L	1953	2.3		Ag 1	99.99 pure; polycrystal; annealed; measured in a transverse field of 4.2 kilooersteds.
19	342	L	1953	2.2		Ag 2	99.999 pure; polycrystal; annealed; measured in a tranverse field of 1.09 kilooersteds.
20	342	L	1953	2.2		Ag 2	The above specimen measured in a transverse field of 1.75 kilooersteds.
21	342	L	1953	3.2		Ag 2	The above specimen measured in a transverse field of 1.97 kilooersteds.
22	342	L	1953	2.2		Ag 2	The above specimen measured in a transverse field of 2.7 kilooersteds.
23	342	L	1953	3.2		Ag 2	The above specimen measured in a transverse field of 3.6 kilooersteds.
24	342	L	1953	2.2		Ag 2	The above specimen measured in a longitudinal field of 3.6 kilooersteds.
25	342	L	1953	2.2		Ag 2	The above specimen measured in a transverse field of 3.7 kilooersteds.
26	246	T	1919	273, 373			1 mm dia wire; rolled and drawn; heated 0.5 hr at temp close to melting point; electrical conductivity reported as 57.0 and 41.3 x 10^4 ohm^{-1} cm^{-1} at 0 and 100 C, respectively.
27	436	L	1938	21.18		Ag 37	Single crystal.
28	436	L	1938	21.24		Ag 37	The above specimen measured at H (the transverse magnetic field strength) = 8810 oersteds and at θ (the angle of rotation of the magnetic field in a plane perpendicular to the specimen axis) = + 1° at which the dependence of k on H is maximum.
29	436	L	1938	21.26		Ag 37	The preceding specimen measured at H = 10850 oersteds and at θ = + 1°.
30	436	L	1938	21.18		Ag 37	The above specimen measured without magnetic field.
31	436	L	1938	21.20		Ag 37	The above specimen measured at H = 4580 oersteds and at θ = + 45° at which the dependence of k on H is minimum.
32	436	L	1938	21.26		Ag 37	The above specimen measured at H = 8810 oersteds and at θ = + 45°.
33	436	L	1938	21.27		Ag 37	The above specimen measured at H = 10850 oersteds and at θ = + 45°.
34	58	L	1934	79, 91		Ag e_4	Pure; single crystal; deformed; electrical resistivity 1.50 μohm cm at 0 C.
35	58	L	1934	80		Ag e_4	The above specimen annealed for 2 hrs at 350 C; electrical resistivity 1.49 μohm cm at 0 C.
36	58	•	1934	80, 91		Ag e_5	Pure; single crystal.
37	504	P	1961	295.2	±5		Pure; 1.9 x 1.9 x 0.322 cm; thermal conductivity value calculated from measured datum of thermal diffusivity using specific heat and density values taken from Smithsonian Physical Tables (9th ed., 1954).

SPECIFICATION TABLE NO. 52 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
38	51	L	1956	14-94		Ag-Mn 3	0.14 at. % Mn; polycrystal; rectangular rod specimen of square cross section 2.5 x 2.5 mm; annealed at 720 K for several hrs in vacuo; electrical resistivity reported as 0.233, 0.234, 0.235, 0.237, 0.473, 0.534, 0.595, and 1.69 μohm cm at 14, 16, 18, 20, 70, 80, 90, and 273 K, respectively; electrical resistivity ratio $\rho(273K)/\rho_0$ = 7.26.
39	51	L	1956	15-94		Ag-Mn 2	0.32 at. % Mn; polycrystal; rectangular rod specimen of square cross section 2.5 x 2.5 mm; annealed at 720 K for several hrs in vacuo; electrical resistivity reported as 0.523, 0.521, 0.523, 0.526, 0.772, 0.830, 0.881, and 1.98 μohm cm at 14, 16, 18, 20, 70, 80, 90, and 273 K, respectively; electrical resistivity ratio $\rho(273K)/\rho_0$ = 3.77.
40	22	L	1959	1.6-74			0.14 at. % Mn; polycrystal; prepared from pure silver and from manganese of 99.995+ pure; melted, rolled, and cut into rods of cross sectional area ~2.5 mm^2; residual electrical resistivity 0.27 μohm cm.
41	22	L	1959	1.5-76			0.32 at. % Mn; polycrystal with fine grains; same fabrication method as above; residual electrical resistivity 0.54 μohm cm.
42	649	L	1956	1.5-4.1			0.14 at. % Mn; measured in a magnetic field of 25.5 kilooersteds.
43	649	L	1956	1.9-4.1			0.14 at. % Mn; measured in a magnetic field of 19 kilooersteds.
44	649	L	1956	1.4-4.0			0.14 at. % Mn; measured in a magnetic field of 12 kilooersteds.
45	649	L	1956	3.0-4.0			0.32 at. % Mn; measured in a magnetic field of 19 kilooersteds.
46	649	L	1956	1.5-4.0			0.32 at. % Mn; measured in a magnetic field of 25.5 kilooersteds.
47	230	L	1925	333			99.9 pure; electrical conductivity 58.8 x 10^4 ohm^{-1} cm^{-1} at 25 C.
48	241	E	1911	298			Impurities < 0.3; electrical conductivity 57.35 x 10^4 ohm^{-1} cm^{-1} at 25 C.
49	617	E	1957	338-917			99.99 pure; polycrystal; electrical resistivity reported as 1.89, 2.21, 2.97, 4.62, and 5.91 μohm cm at 338.2, 385.2, 503.2, 753.2, and 917.2 K, respectively; Lorenz function reported as 2.45, 2.46, 2.45, 2.42, and 2.44 x 10^{-8} V^2 K^{-2} at the above temps, respectively.
50	650	E	1960	306			99.99 pure.
51	736	L	1965	0.43-0.93			Pure silver wire.
52	382	L	1966	1.9-22	2.0	69 grade	0.005 at. % Mn; prepared from 99.9999 pure silver supplied by Cominco and 99.95 pure manganese supplied by Johnson Matthey and Mallory; melted in argon; chill cast, rolled to 1 mm thick, rectangular wire cut from the ingot; annealed at 750 C for 4 hrs in a vacuum of < 2 x 10^{-4} torr.
53	382	L	1966	1.8-82	2.0	59 grade	0.067 at. % Mn; same sources of materials and fabrication method as above.
54	382	L	1966	2.0-85	2.0	59 grade	0.11 at. % Mn; same sources of materials and fabrication method as above.
55	382	L	1966	1.8-86	2.0	59 grade	0.31 at. % Mn; same sources of materials and fabrication method as above.

SPECIFICATION TABLE NO. 52 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
56	570	L	1963	2.2-30	1.5	1	Pure; specimen 3 mm in dia and about 6 cm long; supplied by Engelhard Industries in Toronto; rolled and drawn, etched with nitric acid; annealed at 850 C in vacuo for 3 hrs; residual electrical resistivity 799 μμ ohm cm.
57	570	L	1963	2.2-17	1.5	2	Similar to the above specimen except residual electrical resistivity 670 μμ ohm cm.
58	903	L	1966	3.4-29		HPM735; 1	99.9999 Ag, 0.00001 Fe, 0.00001 Si, < 0.00001 Ca, and < 0.00001 Mg; fine grain polycrystalline; obtained from the Consolidated Mining and Smelting Co.; remelted and outgassed, annealed at 550 C for 24 hrs; residual electrical resistivity 0.00081 μohm cm.
59	903	L	1966	5.3-14		HPM735; 2	Similar to the above specimen except annealed at 530 C for 24 hrs and residual electrical resistivity 0.00088 μohm cm.
60	904	C	1962	298.2			0.05 In, cast; copper used as comparative material.
61	1063	E	1927	273.2			99.9 pure; 0.125 in. dia x 10 cm long; obtained from Baker and Co.; electrical resistivity 1.491 μohm cm at 0 C.
62	79	E	1933	90-373			Traces of Bi, Cd, Cu, Pb, Mg, Si, and Na; 0.06095 cm dia x 9.770 cm long; drawn from a rod of H.S. brand silver supplied by A. Hilger Ltd.; electrical resistivity reported as 0.377, 1.036, 1.509, and 2.121 μohm cm at -183.00, -78.50, 0, and 100 C, respectively; measured in a vacuum of 10^{-4} mm Hg.

DATA TABLE NO. 52 THERMAL CONDUCTIVITY OF SILVER

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1} K^{-1}$]

CURVE 1

T	k
14.4	1.710
16.0	1.860
16.6	1.920
17.7	2.130
19.5	2.540
21.3	3.050

CURVE 2

T	k
15.4	42.00
15.7	41.20
16.1	40.30
16.6	39.40
17.0	38.40
17.3	37.70
18.7	34.20
19.4	33.20
20.0	31.10
21.0	30.00
21.4	23.10

CURVE 3

T	k
15.5	19.50
17.0	17.60
18.5	17.10
19.9	15.30
20.0	15.60
70.2	2.57
76.8	2.56
81.4	2.50
85.2	2.42
89.5	2.54

CURVE 4

T	k
291.2	4.210
373.2	4.150

CURVE 5

T	k
437.2	3.749
508.2	3.711
538.2	3.615

CURVE 5 (cont.)

T	k
570.2	3.673
599.2	3.686
660.2	3.506
695.2	3.540
732.2	3.569
759.2	3.648
794.2	3.628
838.2	3.753

CURVE 6

T	k
21.0	9.46
21.4	9.48
21.6	9.52
79.1	4.44
79.7	4.38
91.0	4.30

CURVE 7

T	k
2.30	1.311
3.40	1.967
4.50	2.568
6.33	3.661
7.43	4.700
9.72	6.011
11.20	6.557
13.92	7.760
16.71	8.634
20.97	8.743
22.11	8.525
23.81	8.470
24.79	8.415
26.32	8.306
28.12	7.980
29.70	7.923
31.67	7.650
33.74	7.380
35.22	6.830
37.90	6.557

CURVE 8*

T	k
283.2	4.105

CURVE 8 (cont.)*

T	k
286.6	4.100
290.4	4.105

CURVE 9*

T	k
278.2	4.033
279.0	4.029
281.9	4.038
284.0	4.038

CURVE 10

T	k
110.2	4.150
113.2	4.176
123.2	4.185
148.2	4.205
173.2	4.218
198.2	4.200
223.2	4.172
248.2	4.170
273.2	4.105
291.2	4.075
306.2	4.020

CURVE 11

T	k
1.47	5.45
2.00	6.90
2.21	7.79
2.95	10.45
3.21	11.54
3.63	12.55
4.47	15.34
4.74	16.56
5.00	17.45
6.00	20.10
6.16	21.50
7.58	25.36
8.95	28.20
10.43	30.35
11.79	31.66
12.42	32.35
14.74	32.75
17.63	31.25

CURVE 11 (cont.)

T	k
21.40	26.95
23.10	24.26
27.10	19.65
30.00	16.25
33.16	13.65
37.58	11.16
43.58	9.45

CURVE 12*

T	k
90.2	4.259
194.7	4.205
273.2	4.180
373.2	4.176

CURVE 13

T	k
1.98	0.298
4.47	0.596
10.00	1.277
12.75	1.532
16.17	1.915
19.15	2.130
22.55	2.468
25.95	2.765
31.95	2.895
38.00	2.935
56.60	2.980
65.95	3.010
77.87	3.060
95.75	3.190
106.60	3.275
120.60	3.360
139.60	3.575

CURVE 14

T	k
3.27	108.50
3.62	120.00
3.83	134.50
4.04	145.50
5.10	174.00
14.05	115.00
16.15	82.10

CURVE 14 (cont.)

T	k
18.70	60.85
22.13	40.85
25.32	26.80
31.06	17.50
36.20	11.70
40.45	9.560
55.97	5.380
61.90	4.800
67.25	4.725
75.55	4.530
95.75	4.320
110.85	4.255
130.60	4.255

CURVE 15

T	k
1.70	1.702
2.87	2.235
3.40	2.980
4.25	3.550
10.43	7.745
14.50	9.615
16.80	10.130
19.35	10.760
23.20	10.380
28.50	8.830
34.05	7.553
41.70	5.870
54.90	5.020
62.55	4.550
76.60	4.340
95.50	4.309
115.50	4.210*
134.05	4.210*

CURVE 16

T	k
2.98	56.38
3.60	66.80
4.25	74.90
4.58	84.70
10.20	111.50
10.85	105.30
12.98	93.60

CURVE 16 (cont.)

T	k
14.05	80.85
15.53	72.35
17.23	59.58
19.35	46.80
21.70	36.17
26.38	25.53
31.50	16.60
41.05	10.12
54.68	6.380
66.17	5.900
79.15	5.530
96.60	5.105
118.95	5.105
135.10	5.105

CURVE 17

T	k
2.38	23.4
2.88	34.9
3.50	43.0
4.38	55.8
4.75	63.9
9.56	102.5
11.3	99.6
12.9	90.2
15.9	67.6
21.4	39.1
29.8	19.1
57.5	6.15
76.6	5.53
94.8	5.16

CURVE 18

T	k
2.3	1.29

CURVE 19*

T	k
2.2	7.75

CURVE 20

T	k
2.2	7.46

CURVE 21

T	k
3.2	11.14

CURVE 22

T	k
2.2	7.14

CURVE 23

T	k
3.2	10.50

CURVE 24*

T	k
2.2	7.41

CURVE 25

T	k
2.2	6.90

CURVE 26

T	k
273.2	3.96
373.2	3.95

CURVE 27*

T	k
21.19	31.4

CURVE 28

T	k
21.24	23.3

CURVE 29

T	k
21.26	22.0

CURVE 30*

T	k
21.18	31.4

CURVE 31*

T	k
21.20	27.3

* Not shown on plot

DATA TABLE NO. 52 (continued)

T	k
CURVE 32*	
21.26	23.0
CURVE 33	
21.27	21.1
CURVE 34	
78.6	4.27
90.8	4.12
CURVE 35*	
80.0	4.54
CURVE 36*	
79.8	4.25
91.1	4.13
CURVE 37*	
295.2	3.975
CURVE 38	
14.40	1.800
14.80	1.790
15.70	1.870
16.90	1.900
17.90	2.050
18.50	2.100
19.70	2.170
20.40	2.220
21.00	2.350
71.00	3.320
72.20	3.100
79.20	2.950
84.00	2.800
85.00	2.880
93.60	2.900
CURVE 39	
14.6	0.954
14.9	0.938
15.4	0.970
16.3	1.020
16.4	1.070
17.2	1.075
17.4	1.100
18.0	1.120
18.5	1.150
19.4	1.160
19 7	1.220
2[illegible]	1.240
2[illegible]	1.280
74.0	1.950
84.0	1.980
93.5	2.240
CURVE 40	
1.56	0.152
1.84	0.178
1.90	0.190
1.92	0.189
2.11	0.215
2.14	0.210
2.34	0.225
2.42	0.238
2.44	0.244
2.54	0.246
2.73	0.258
2.75	0.263
2.89	0.277
2.94	0.277
2.95	0.278
3.16	0.304
3.19	0.303
3.44	0.329
3.47	0.335
3.74	0.363
3.76	0.367
4.03	0.402
CURVE 40 (cont.)	
4.05	0.422
14.87	1.648
15.97	1.704
16.04	1.688
17.07	1.847
17.10	1.765
17.96	1.842
18.08	1.845
18.90	1.922
19.03	1.981
19.77	2.121
19.86	2.082
19.57	2.148
70.32	2.616
73.84	2.618
CURVE 41	
1.51	0.0755
1.56	0.0805
1.78	0.0943
1.93	0.104
2.12	0.119
2.33	0.132
2.57	0.138
2.72	0.141
2.85	0.149
2.91	0.148
3.03	0.162
3.19	0.171
3.31	0.179
3.40	0.183
3.50	0.186
3.51	0.190
3.55	0.187
3.60	0.189
3.70	0.197
3.80	0.208
4.05	0.228
4.08	0.225
4.08	0.234
CURVE 41 (cont.)	
14.84	1.025
15.70	1.046
16.67	1.112
17.74	1.173
18.77	1.251
19.70	1.343
65.33	2.190
65.35	2.192
67.96	2.227
70.86	2.262
73.34	2.274
76.24	2.333
CURVE 42	
1.52	0.197
1.87	0.245
2.21	0.272
2.56	0.299
2.70	0.320
2.85	0.340
3.20	0.372
3.59	0.409
4.11	0.500
CURVE 43	
1.86	0.231
2.40	0.274
2.87	0.319
4.12	0.474
CURVE 44	
1.40	0.132
2.02	0.222
2.24	0.240
2.59	0.262
3.24	0.349
3.61	0.365
4.03	0.444
CURVE 45	
3.00	0.178
3.20	0.190
3.32	0.194
3.36	0.200
3.48	0.207
3.52	0.207
3.57	0.214
3.67	0.220
3.78	0.229
4.02	0.250
CURVE 46	
1.51	0.096
1.88	0.124
2.01	0.136
2.19	0.150
2.41	0.161
2.60	0.164
2.81	0.172
3.00	0.187
3.01	0.183
3.20	0.197
3.20	0.209
3.29	0.201
3.37	0.206
3.39	0.201
3.47	0.211
3.50	0.221
3.55	0.220
3.67	0.230
3.76	0.234
3.77	0.240
4.02	0.261
CURVE 47	
333	4.05
CURVE 48*	
293	4.08
CURVE 49	
338.2	4.41
352.2	4.36
385.2	4.31
412.2	4.25
455.2	4.23*
503.2	4.18
587.2	4.12
667.2	4.05
753.2	3.96
786.2	3.91
863.2	3.85
917.2	3.80
CURVE 50*	
306	4.068
CURVE 51*	
0.425	0.055
0.450	0.060
0.463	0.0613
0.510	0.0675
0.525	0.0700
0.540	0.0725
0.575	0.0800
0.628	0.0888
0.653	0.090
0.670	0.0925
0.698	0.0938
0.720	0.0962
0.745	0.0975
0.745	0.0950
0.790	0.1025
0.810	0.105
0.840	0.111
0.885	0.119
CURVE 51 (cont.)	
0.890	0.120
0.933	0.129
CURVE 52	
1.91	4.97
2.31	5.70
2.93	7.18
3.10	7.55
3.44	8.07
3.78	9.27
4.13	10.1
6.65	16.0
7.96	19.5
8.47	19.6
9.48	21.6
11.7	25.5
13.9	26.8
16.3	26.5
21.6	23.6
CURVE 53	
1.83	0.532
2.14	0.578
2.29	0.661
2.52	0.708
2.77	0.800
2.95	0.865
3.39	0.993
3.51	1.10
4.06	1.23
5.59	1.70
6.75	2.11
8.81	2.77
9.66	3.03
10.5	3.13
11.7	3.51
14.6	4.41
17.8	4.93
20.9	5.32

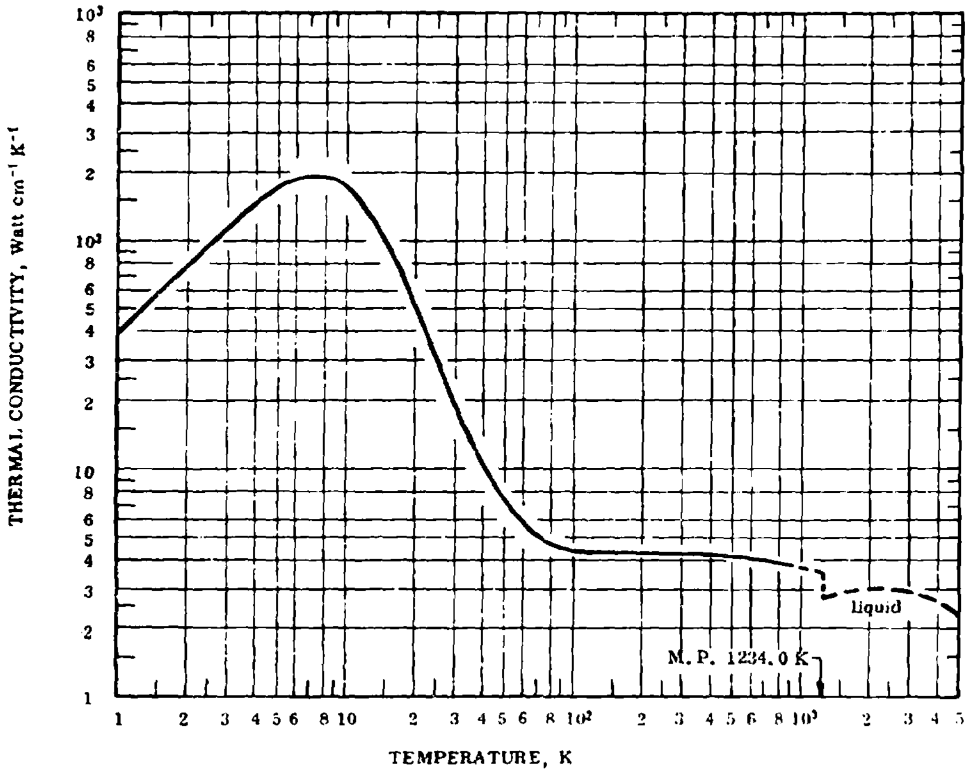
*Not shown on plot

DATA TABLE NO. 52 (continued)

T	k
CURVE 53 (cont.)	
21.8	5.92
30.1	5.57
69.3	4.43
82.4	4.25
CURVE 54	
1.95	0.304
2.10	0.337
2.34	0.368
2.59	0.424
3.20	0.512
3.67	0.588
4.14	0.658
6.27	1.04
6.62	1.09
8.41	1.39
10.4	1.90
13.2	2.36
16.5	2.86
19.9	3.25
22.9	3.61
25.5	4.00
85.3	3.55
CURVE 55	
1.80	0.100*
1.91	0.106*
2.03	0.110*
2.52	0.140*
3.00	0.163*
3.54	0.202
4.16	0.252
5.33	0.353
6.31	0.436
6.79	0.473
7.76	0.589
9.44	0.723
11.3	0.851
15.3	1.08
17.5	1.25
19.3	1.40
22.9	1.56
26.4	1.68
70.8	2.23
86.3	2.41*
CURVE 56	
2.2	70
2.6	80
3.1	95
3.6	108
4.1	119
6.0	151
7.5	161
9.0	157
10.9	138
14.0	107
17.5	67
19.1	55
21.2	43
24.3	31
26.5	25*
30.3	19*
CURVE 57	
2.2	83
2.5	93
2.9	105
5.7	158
9.7	152
11.7	130
14.8	94
16.5	77
CURVE 58	
3.37	95.6
4.11	110.1
4.97	127.7
6.12	140.4
7.14	146.6
9.40	141.2
10.73	131.2
12.62	112.5
13.47	103.5
15.92	78.2
16.86	70.2
18.16	59.6
21.01	43.2*
22.79	35.3*
23.77	31.8*
25.75	26.5*
26.60	24.0*
29.35	18.7*
CURVE 59	
5.33	122.2
6.41	132.8
7.83	137.4
8.55	136.2
10.05	129.0
11.59	117.6
14.30	92.3
CURVE 60	
298.2	2.84
CURVE 61	
273.2	4.44
CURVE 62*	
90.2	4.247
194.7	4.201
273.2	4.180
373.2	4.167

*Not shown on plot

FIGURE AND TABLE NO. 52R RECOMMENDED THERMAL CONDUCTIVITY OF SILVER



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	4.13	239	440.3
1	39.4	2280	-457.9	600	4.05	234	620.3
2	78.3	4520	-456.1	700	3.97	229	800.3
3	115	6640	-454.3	800	3.89	225	980.3
4	147	8490	-452.5	900	3.82	221	1160
5	172	9940	-450.7	1000	(3.74)‡	(216)	1340
6	187	10800	-448.9	1100	(3.66)	(211)	1520
7	193	11200	-447.1	1200	(3.58)	(207)	1700
8	190	11000	-445.3	1234	(3.55)	(205)	1762
9	181	10500	-443.5		In Liquid State		
10	168	9710	-441.7	1234	(1.75)	(101)	1762
11	154	8900	-439.9	1300	(1.78)	(103)	1880
12	139	8030	-438.1	1400	(1.83)	(106)	2060
13	124	7160	-436.3	1500	(1.87)	(108)	2240
14	109	6300	-434.5	1600	(1.90)	(110)	2420
15	96	5550	-432.7	1700	(1.93)	(112)	2600
16	85	4910	-430.9	1800	(1.95)	(113)	2780
18	66	3810	-427.3	1900	(1.96)	(113)	2960
20	51	2950	-423.7	2000	(1.97)	(114)	3140
25	29.5	1700	-414.7	2200	(1.98)	(114)	3500
30	19.3	1120	-405.7	2400	(1.98)	(114)	3860
35	13.7	792	-396.7	2600	(1.97)	(114)	4220
40	10.5	607	-387.7	2800	(1.95)	(113)	4580
45	8.4	485	-378.7	3000	(1.91)	(110)	4940
50	7.0	404	-369.7	3200	(1.87)	(108)	5300
60	5.5	318	-351.7	3400	(1.82)	(105)	5660
70	4.97	287	-333.7	3600	(1.76)	(102)	6020
80	4.71	272	-315.7	3800	(1.70)	(98.2)	6380
90	4.60	266	-297.7	4000	(1.63)	(94.2)	6740
100	4.50	260	-279.7	4500	(1.45)	(83.8)	7640
150	4.32	250	-189.7	5000	(1.23)	(71.1)	8540
200	4.30	248	- 99.7	5500	(1.01)	(58.4)	9440
250	4.28	247	- 9.7	6000	(0.764)	(44.1)	10340
273.2	4.28	247	32.0	6500	(0.514)	(29.7)	11240
300	4.27	247	80.3	7000	(0.250)	(14.4)	12140
350	4.24	245	170.3	7460	(~0)	(~0)	12968
400	4.20	243	260.3				

REMARKS

The recommended values are for well-annealed 99.999+% pure silver with residual electrical resistivity ρ_0 = 0.000620 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 150 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.20, a = 0.55, m = 2.75, α' = 7.30 x 10^{-4}, and β = 0.0254. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 2% of the true values near room temperature, and 2 to 5% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or estimated.

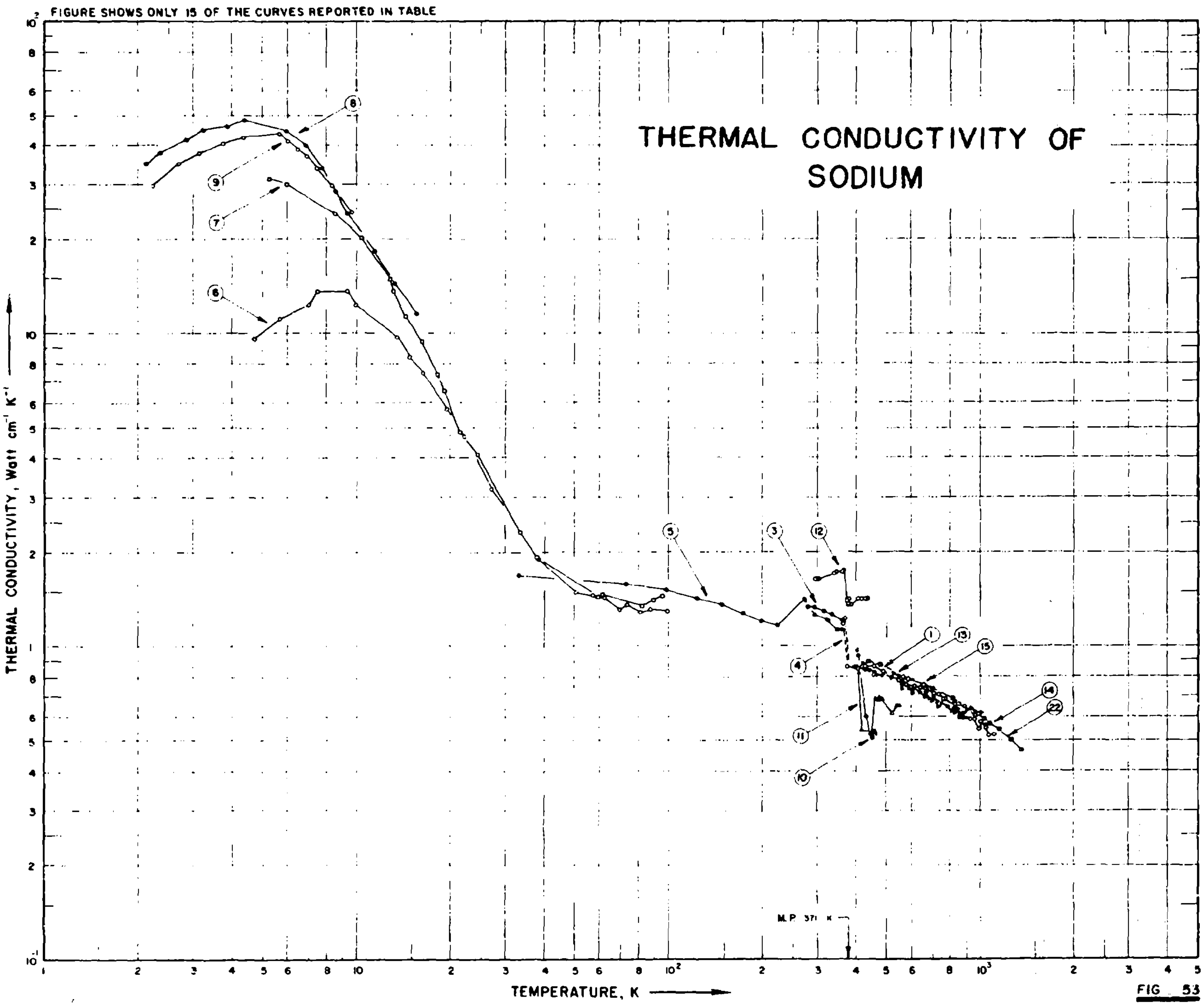


FIGURE SHOWS ONLY 15 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF SODIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 371 K
1
3
4
5
6
7
8
9
10
11
12
13
14
15
22

FIG. 53

SPECIFICATION TABLE NO. 53 THERMAL CONDUCTIVITY OF SODIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 53]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	105	P	1956	374-961			Pure; thermal conductivity values calculated from measured (in argon) thermal diffusivity data using specific heat data of Ginnings, D.C., et al (J. Res., NBS, 45, 1950) and density data of Miller, R.R. (Liquid Metals Handbook, 2nd ed, 1952).
2	502, 38	L	1951	455-786	1		Impurities: 0.0001 to 0.001 Ag, < 0.00001 K, < 0.001 O, and negligible amounts of Li, Si, Be, Cs, Rb, Ca, Al, Mg, Fe, Cr, Ni, Sn, and Pb; distilled.
3	72	E	1913	279-361			Pure, supplied by Eimer and Amend; electrical resistivity reported as 4.66, 5.06, 5.63, 6.04, and 6.63 μ ohm cm at 5.7, 21.5, 42.1, 61.4, and 88.1 C, respectively.
4	65	L	1938	358-485			Pure; measured across melting point (97.5 C); electrical conductivity 1.02 and 0.73 x 10^5 ohm^{-1} cm^{-1} at 100 and 200 C, respectively; extrapolation of the thermal conductivity data for the solid and the liquid state to the melting point gives the ratio 1.33.
5	12	F	1926	33-348			Pure; 1.10 cm in dia, 25 cm long; extruded; electrical resistivity 4.26 μ ohm cm at 0 C.
6	10	L	1951	4.7-99	2-3	Na I	Approx 0.01 to 0.1 Ca and Al; supplied by British-Thomson-Houston Research Lab.; cast under vacuum in soft glass tubes; electrical conductivity ranging from 106 to 3.15 x 10^6 ohm^{-1} cm^{-1} at 2 to 46.7 K.
7	10	L	1951	5.3-96	2-3	Na II	Trace of Ag; supplied by Messrs. Philips Ltd, Mitcham; cast under vacuum in soft glass tubes; electrical conductivity ranging from 756 to 1.0 x 10^6 ohm^{-1} cm^{-1} at 2 to 90 K.
8	92	L	1956	2.1-16		Na 2	High purity; 0.5 mm in dia; electrical resistivity ratio ρ(295 K)/ρ(0 K) = 3420 (using Hackspill's value ρ(295 K) = 4.75 μohm cm).
9	92	L	1956	2.2-9.6		Na 3	High purity; 0.13 mm in dia; electrical resistivity ratio ρ(295 K)/ρ(0 K) = 2860 (using Hackspill's value ρ(295 K) = 4.75 μohm cm).
10	243	L	1950	407-462			Commercial grade (high purity); supplied by Mine Safety Appliance Co.; 0.684 in. dia; M.P. 97.9 C; specimen in liquid state; apparatus in open air.
11	243	L	1950	403-549			The above specimen; apparatus in heated oven.
12	385	L	1940	296-433	2		Distilled; measured across melting point (approx. 97 C).
13	592	L	1959	402-1011			M.P. 97.5 C; specimen in liquid state; measured in vacuum of approx. 4 x 10^{-4} mm Hg.
14	866, 769	P	1961	623-1153	± 2.5		Impurities (after test): 0.049 Cr, 0.041 K, 0.016 Fe, 0.016 O, 0.014 Ni, < 0.002 Pb, 0.0017 Mn, 0.0011 Ti, < 0.001 Al, 0.00045 Cu, 0.0003 Ca, 0.00027 Mg, and 0.0002 Ag; distilled; 8.4 mm dia, approx. 230 mm long; in liquid state; measured in vacuum; data calculated from an empirical equation derived from experimental data.
15	770, 853	C	1965	363-1103	5.5		Melting point 97.81 C; specimen in liquid state; AISI 304 stainless steel used as comparative material.
16	148, 857		1966	900-1500	± 20		Vapor; measured in the 1 mm gap between concentric cylinders 900 mm long; vapor pressure = 0.01 kg cm^{-2}.

SPECIFICATION TABLE NO. 53 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
17	148, 857		1966	1000-1500	± 20		Similar to the above except vapor pressure = 0.05 kg cm^{-2}.
18	148, 857		1966	1000-1500	± 20		Similar to the above except vapor pressure = 0.1 kg cm^{-2}.
19	148, 857		1966	1100-1500	± 20		Similar to the above except vapor pressure = 0.5 kg cm^{-2}.
20	148, 857		1966	1200-1500	± 20		Similar to the above except vapor pressure = 1.0 kg cm^{-2}.
21	148, 857		1966	800-1200	± 20		Similar to the above except measured on saturation curve.
22	861, 859, 860		1964	437-1366			Density reported as 0.8977, 0.8255, 0.8119, 0.7881, 0.7640, 0.7381, and 0.6967 g cm^{-3} at 483.8, 804.1, 873.1, 972.7, 1085, 1189, and 1384 K, respectively; electrical resistivity reported as 5.23, 5.72, 6.54, 6.70, 6.82, 11.04, 11.10, 11.99, 12.42, 14.54, 15.61, 16.25, 18.01, 20.09, 21.86, 24.76, 28.01, 31.54, 35.31, 37.35, 41.76, 46.44, 48.94, 54.16, 60.10, 66.17, 69.59, and 72.48 μohm cm at 302, 324, 356, 365, 370, 406, 413, 431, 444, 501, 525, 542, 554, 630, 668, 726, 790, 850, 913, 945, 1009, 1079, 1108, 1171, 1238, 1300, 1334, and 1360 K, respectively; thermal conductivity values calculated from measured electrical resistivity data and the Lorenz number 2.45×10^{-8} V^{2}K^{-2}.
23	756, 862		1962	473-1173			Composition (pretest): < 0.0375 Cs, < 0.0375 K, < 0.0150 Li, 0.0066 Fe, 0.0048 N, 0.0032 O, 0.0022 Ni, and < 0.0010 Cr; composition (posttest): < 0.0375 Cs, < 0.0375 K, 0.0215 C, < 0.0150 Li, 0.0055 O, 0.0049 N, 0.0045 Fe, < 0.0010 Cr, and < 0.0009 Ni; purchased from U.S. Industrial Chemicals Co.; purified by melting and forcing the molten liquid through a 20 micron stainless steel filter under purified argon; electrical resistivity reported as 9.64, 11.44, 13.78, 17.98, 23.16, 28.68, 34.91, 41.86, 46.40, and 51.60 μ ohm cm at 371.2, 424.5, 482.5, 585.7, 693.9, 804.4, 908.7, 1012.8, 1072.8, and 1126.0 K, respectively; thermal conductivity values calculated from electrical resistivity data using Lorenz function of 2.31, 2.31, 2.33, 2.33, 2.36, 2.41, 2.48, and 2.52×10^{-8} V^{2}K^{-2} at 473, 573, 673, 773, 873, 973, 1073, and 1123 K, respectively, the first four values being derived from the thermal conductivity measurements of Ewing, C.T. and Grand, J.A. (NRL Rept. 3835, 1951) and the authors' own electrical resistivity data.
24	868, 867	L	1965	328	< 15		0.13 Na_2O.

DATA TABLE NO. 53 THERMAL CONDUCTIVITY OF SODIUM

(Impurity 0.20% each; total impurities 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
374.4	0.852
405.0	0.840
419.1	0.851
427.3	0.858
459.1	0.852
489.7	0.824
546.1	0.773
577.9	0.755
615.6	0.743
640.3	0.732
709.7	0.702
737.9	0.697
759.1	0.674
773.2	0.674
832.0	0.649
890.8	0.640
961.4	0.598

CURVE 2

T	k
454.9	0.830
455.0	0.834
508.9	0.790
540.7	0.773
542.5	0.773
647.5	0.723
648.3	0.724
769.4	0.670
785.7	0.664

CURVE 3

T	k
279.0	1.343
294.4	1.326
315.1	1.282
334.5	1.258
361.3	1.205

CURVE 4

T	k
357.9	1.133
361.4	1.128*
364.7	1.127
374.3	0.852
380.0	0.855
388.7	0.850
398.2	0.851
411.5	0.853
428.6	0.837
439.0	0.831
458.2	0.819
466.5	0.807
485.2	0.799

CURVE 5

T	k
33	1.686
73	1.577
98	1.506
123	1.423
148	1.356
173	1.276
198	1.205
223	1.172
273	1.402
293	1.255
323	1.213
348	1.130

CURVE 6

T	k
4.72	9.544
5.67	11.030
7.01	12.360
7.48	13.540
9.29	13.620
9.92	12.320
13.54	9.660
14.80	8.355
16.38	7.452
19.53	5.703

CURVE 6 (cont.)

T	k
22.21	4.677
27.09	3.186
38.27	1.886
50.55	1.483
57.00	1.445
62.36	1.422
69.50	1.316
73.40	1.354
81.10	1.285
87.24	1.316
98.90	1.293

CURVE 7

T	k
5.25	31.140
5.98	30.020
8.50	24.030
10.39	20.000
12.76	14.830
13.07	13.650
14.33	11.300
16.14	9.392
18.11	7.376
19.06	6.502
21.42	4.830
24.41	4.070
33.23	2.320
37.80	1.916
59.20	1.437
61.70	1.452
82.05	1.386
89.30	1.400
95.60	1.445

CURVE 8

T	k
2.12	34.810
2.35	37.950
2.85	41.640
3.23	45.000
3.85	46.150

CURVE 8 (cont.)

T	k
4.35	48.460
5.92	44.230
6.85	40.900
7.70	33.650
8.50	28.650
9.31	24.040
11.35	18.460
13.27	14.420
15.54	11.540

CURVE 9

T	k
2.23	29.810
2.69	34.620
3.15	37.500
3.73	40.400
4.35	42.310
5.65	43.650
6.08	41.150
6.50	38.650
6.92	36.730
7.46	33.650
8.31	29.810
9.62	24.230

CURVE 10

T	k
407.2	0.925
430.2	0.594
445.2	0.519
450.2	0.502
453.2	0.519
456.2	0.510
456.2	0.493*
457.2	0.498
457.2	0.531*
459.2	0.536
460.2	0.519
460.2	0.519
460.2	0.519*
462.2	0.506*

CURVE 11

T	k
403.2	0.958
409.2	0.816
418.2	0.536
450.2	0.523
461.2	0.678
461.2	0.678
472.2	0.686
472.2	0.678
472.2	0.678
481.2	0.678
521.2	0.607
541.2	0.640
541.2	0.640
549.2	0.640
549.2	0.640
549.2	0.640

CURVE 12

T	k
296.4	1.63
298.0	1.63
300.8	1.63
302.2	1.63
343.2	1.695
345.2	1.705
361.7	1.72
363.7	1.725
375.7	1.38
376.2	1.385
378.2	1.36
379.7	1.35
382.2	1.35
408.2	1.405
418.5	1.407
428.0	1.41
433.2	1.41

CURVE 13

T	k
401.7	0.848
410.7	0.854

CURVE 13 (cont.)

T	k
418.2	0.832*
421.2	0.860
424.7	0.845*
425.2	0.825*
435.2	0.846*
444.2	0.839*
473.2	0.831*
489.2	0.814*
506.2	0.814*
512.2	0.808
520.2	0.790
527.2	0.814
531.7	0.819*
532.2	0.790*
543.2	0.779*
549.2	0.796
554.2	0.791*
557.2	0.767*
561.2	0.728
563.2	0.766
582.2	0.755*
588.2	0.751*
592.2	0.732
594.7	0.752*
596.2	0.729*
603.2	0.744*
607.7	0.726*
608.2	0.703
613.2	0.732
619.2	0.718*
625.2	0.717*
634.2	0.732*
639.2	0.709
649.2	0.697*
649.7	0.732*
659.2	0.721
666.2	0.686
669.2	0.709
673.2	0.703*
675.7	0.686*
678.2	0.703*

CURVE 13 (cont.)

T	k
685.2	0.680
689.2	0.710*
698.2	0.668
704.7	0.672*
709.2	0.686
719.2	0.679*
723.2	0.665
733.2	0.688*
734.2	0.639
738.7	0.664*
743.2	0.661*
753.2	0.652
757.2	0.664*
760.2	0.660*
763.2	0.645*
764.2	0.673*
781.2	0.676*
787.8	0.639
790.7	0.628*
801.2	0.638*
811.4	0.618
824.2	0.618*
825.2	0.668
827.5	0.608
828.2	0.636*
835.2	0.629*
848.5	0.629
853.2	0.610
858.2	0.593
876.2	0.639*
884.2	0.610
899.2	0.604*
904.2	0.622
936.2	0.630
948.2	0.606*
964.2	0.614
1010.7	0.614

CURVE 14

T	k
623.2	0.732*

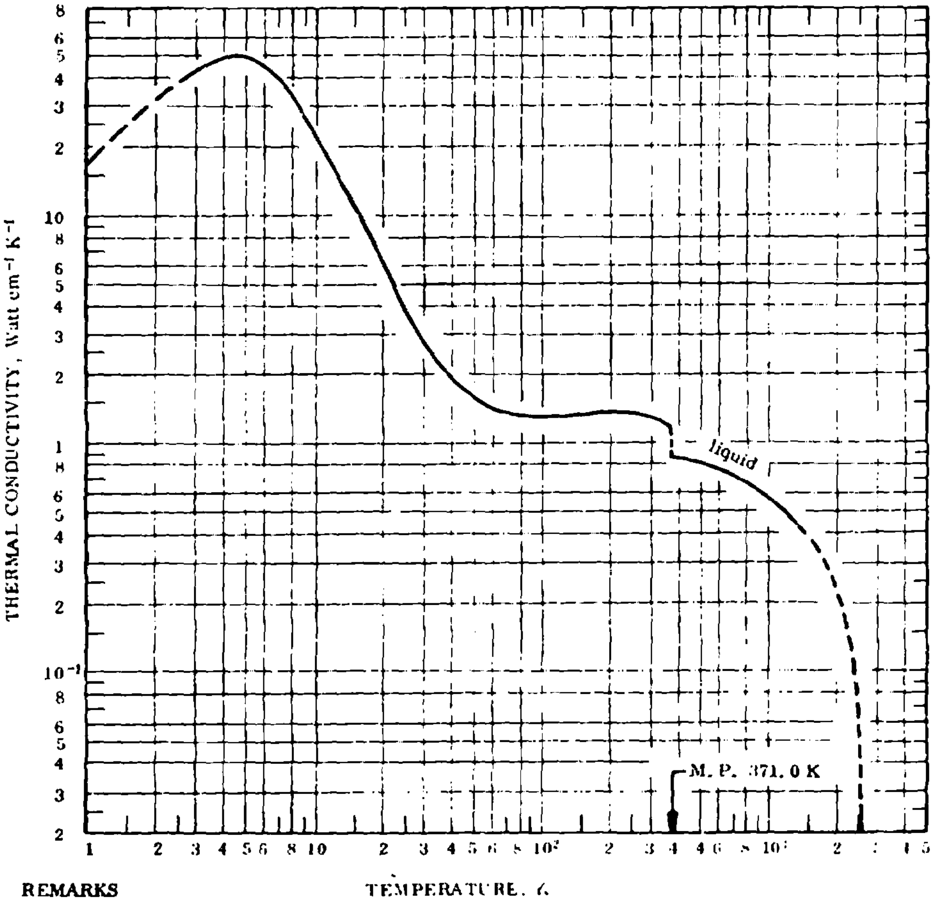
* Not shown on plot

DATA TABLE NO. 53 (continued)

T	k
CURVE 14 (cont.)	
673.2	0.711*
773.2	0.665*
873.2	0.628*
973.2	0.590
1073.2	0.561
1153.2	0.540
CURVE 15	
363	1.180
358	1.224
378	0.860
413	0.836*
458	0.808
518	0.790*
583	0.783
588	0.780
658	0.740*
660	0.748
701	0.700*
748	0.676*
783	0.662*
838	0.632*
883	0.614*
928	0.584
958	0.580
990	0.542
1000	0.572
1046	0.548
1063	0.518
1103	0.520
CURVE 16*	
900	0.000358
1000	0.000341
1100	0.000360
1200	0.000391
1300	0.000422
1400	0.000455
1500	0.000489
CURVE 17*	
1000	0.000436
1100	0.000394
CURVE 17 (cont.)*	
1200	0.000405
1300	0.000429
1400	0.000459
1500	0.000492
CURVE 18*	
1000	0.000497
1100	0.000430
1200	0.000422
1300	0.000438
1400	0.000464
1500	0.000495
CURVE 19*	
1100	0.000609
1200	0.000529
1300	0.000499
1400	0.000499
1500	0.000516
CURVE 20*	
1200	0.000612
1300	0.000556
1400	0.000535
1500	0.000541
CURVE 21*	
800	0.000485
900	0.000545
1000	0.000593
1100	0.000628
1200	0.000658
CURVE 22	
437	0.883
478	0.860
589	0.793*
700	0.732
811	0.680
922	0.629*
CURVE 22 (cont.)	
1033	0.585
1144	0.540*
1255	0.498
1366	0.460
CURVE 23*	
473.2	0.815
573.2	0.768
673.2	0.711
773.2	0.668
873.2	0.631
973.2	0.600
1073.2	0.573
1173.2	0.549
CURVE 24	
328	1.236

*Not shown on plot

FIGURE AND TABLE NO. 53R RECOMMENDED THERMAL CONDUCTIVITY OF SODIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(16.6)‡	(959)	-457.9
2	(31.8)	(1940)	-456.1
3	43.2	2500	-454.3
4	48.5	2800	-452.5
5	48.2	2780	-450.7
6	44.2	2550	-448.9
7	38.4	2220	-447.1
8	31.7	1830	-445.3
9	26.3	1520	-443.5
10	22.0	1270	-441.7
11	18.8	1090	-439.9
12	16.1	930	-438.1
13	14.0	809	-436.3
14	12.2	705	-434.5
15	10.7	618	-432.7
16	9.40	543	-430.9
18	7.48	432	-427.3
20	6.09	352	-423.7
25	3.94	228	-414.7
30	2.83	164	-405.7
35	2.22	128	-396.7
40	1.89	109	-387.7
45	1.71	98.8	-378.7
50	1.58	91.3	-369.7
60	1.45	83.8	-351.7
70	1.38	79.7	-333.7
80	1.34	77.4	-315.7
90	1.33	76.8	-297.7
100	1.32	76.3	-279.7
150	1.33	76.8	-189.7
200	1.38	79.7	-99.7
250	1.37	79.2	-9.7
273.2	1.35	78.0	32.0
300	1.32	76.3	80.3
350	1.23	71.1	170.3
371.0	1.20	69.3	208.1

T_1	k_1	k_2	T_2
	In Liquid State		
371.0	0.88	50.8	208.1
400	0.865	50.0	260.3
500	0.815	47.1	440.3
600	0.764	44.1	620.3
700	0.715	41.3	800.3
800	0.668	38.6	980.3
900	0.625	36.1	1160
1000	0.583	33.7	1340
1100	0.543	31.4	1520
1200	0.503	29.1	1700
1300	0.465	26.9	1880
1400	0.428	24.7	2060
1500	0.393	22.7	2240
1600	(0.358)	(20.7)	2420
1700	(0.325)	(18.8)	2600
1800	(0.292)	(16.9)	2780
1900	(0.260)	(15.0)	2960
2000	(0.229)	(13.2)	3140
2200	(0.170)	(9.82)	3500
2400	(0.112)	(6.47)	3860
2600	(0.056)	(3.24)	4220
2800	(0.0013)	(0.0751)	4580

REMARKS

The recommended values are for high-purity sodium with residual electrical resistivity ρ_0 = 0.00147 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 100 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.00, α' = 3.50 x 10^{-4}, and β = 0.0600. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or estimated.

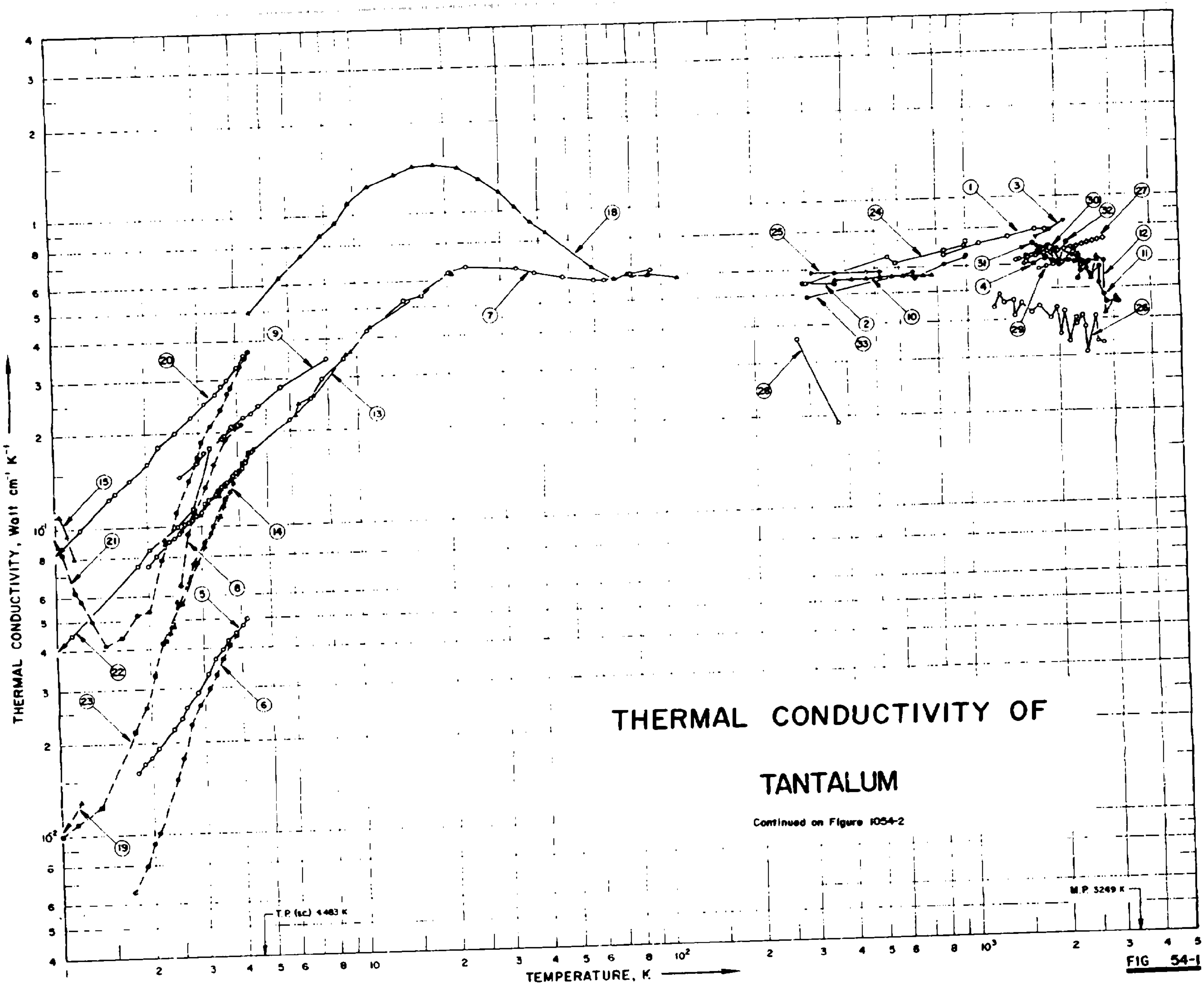

THERMAL CONDUCTIVITY OF
TANTALUM
Continued on Figure 1054-2
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P. (sc) 4.483 K
M.P. 3249 K

FIG 54-1

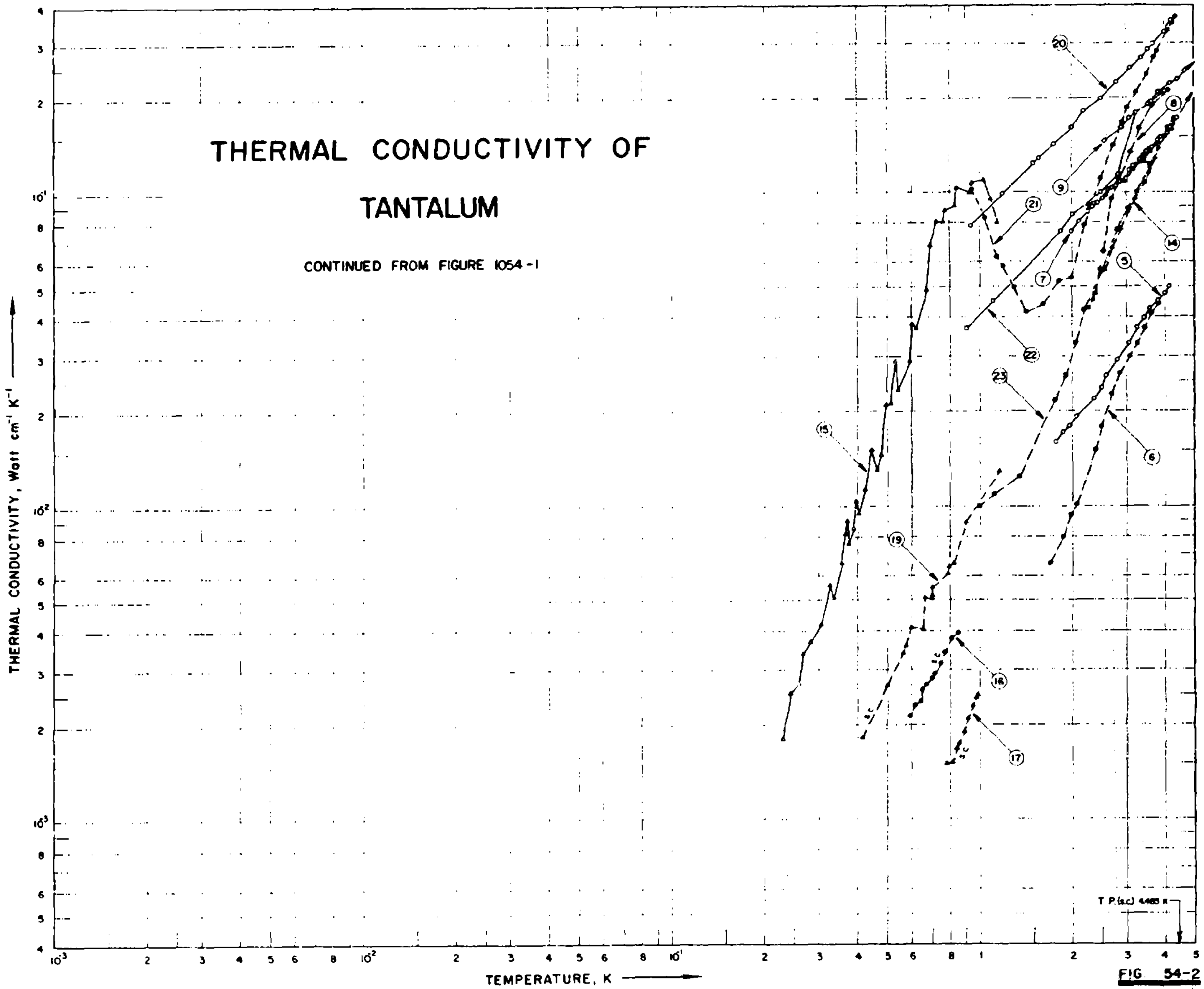

THERMAL CONDUCTIVITY OF
TANTALUM
CONTINUED FROM FIGURE 1054-1
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P.(s.c.) 4.483 K
15
19
16
17
20
9
21
8
7
14
5
22
23
6

FIG 54-2

SPECIFICATION TABLE NO. 54 THERMAL CONDUCTIVITY OF TANTALUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 54]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	42	L	1956	842-1820	5		Impurities (pre-test): 0.052 N, traces of Ca, Cu, and Mg; impurities (after test): 0.12 O, 0.044 N, 0.0061 H, traces of Al, Ca, Cu, Fe, and Mg; sintered; density 16.48 g cm^{-3}.
2	8	F	1914	290, 373			Pure; 0.0475 cm dia x 28.14 cm long; specific gravity 16.67; electrical resistivity reported as 14.452 and 19.178 μohm cm at 0 and 100 C, respectively.
3	153	E	1914	1700-2100			Pure; filament.
4	849		1966	1665-2671		No. 5	0.0036 O, 0.0018 N, 0.00009 H, and 0.00005 C; 1.9062 cm dia x 0.2273 cm thick; machined from a 1 in. rod supplied by Fansteel Metallurgical Corp; average grain size 1.86 mm; density 16.60 g cm^{-3}; thermal conductivity derived from the temp distribution on the flat surface of the cylindrical disc heated in vacuum by induction.
5	74	L	1950	1.7-4.2	3	Hilger 8017, Ta1	99.9 pure; polycrystalline; superconducting transition point 4.38 K; measured in a magnetic field; in normal state.
6	74	L	1950	1.7-3.9	3	Hilger 8017, Ta1	The above specimen in superconducting state.
7	122	L	1955	2.0-92	3	JM3804; Ta1	99.98 pure; polycrystalline; specimen 0.225 cm in dia, 3 cm long; Johnson Matthey's unannealed rod; electrical resistivity ratio $\rho(293K)/\rho(20K)$ = 19.7; electrical resistivity reported as 0.62, 0.63, 0.67, 0.90, 1.05, 1.46, 2.07, 2.35, 3.04, and 3.51 μohm cm at 11.3, 16.1, 20.5, 32.2, 37.2, 46.9, 59.6, 65.1, 78.4, and 89.4 K, respectively; superconducting transition temp 4.38 K; measured in a magnetic field; in normal state.
8	96	L	1950	2.6-4.2	2-5		Very pure; in superconducting state.
9	96	L	1950	2.6-7.9	2-5		Very pure; measured in a magnetic field; in normal state.
10	182	L	1959	373-773	5		99.896 Ta, 0.0300 Nb, 0.0140 O, 0.0100 W, 0.0100 Zn, 0.0060 N, 0.0050 Mo, 0.0025 C, 0.0025 H, 0.0030 each of Pb, Sn, and Zr, 0.0020 each of Co, Sr, and V, 0.0010 each of Al, Ba, Bi, Cr, Fe, and Ni, 0.0005 each of Ag and Ti, 0.0003 each of B, Mn, Si, and Na, 0.0002 Be, and 0.0001 each of Ca, Cu, and Mg; specimen bar machined from a rod obtained from Fansteel Metallurgical Corp; data taken from smoothed curve.
11	255	E	1960	2343-3148		1	< 0.02 Si, 0.005 Fe, 0.003 Mo, 0.0008 C, and 0.052 others; prepared by pressing and sintering tantalum powder, then hot and cold rolled.
12	255	E	1960	2326-3071		2	0.0032-0.005 O, 0.0035 Nb, 0.0028 Fe, 0.0016 C, <0.001 N, and 0.0175 others; cast in vacuum, cold rolled, swaged, and cold drawn.
13	97	L	1952	2.3-21	2-3	JM3804; Ta1	99.98 pure; 1-2 mm dia x 5 cm long; obtained from Johnson Matthey Co.; measured in a magnetic field; in normal state.
14	97	L	1952	2.3-3.9	2-3	Ta 1	The above specimen in superconducting state.
15	705	L	1962	0.23-1.2	5	Ta II	Single crystal; specimen dia 6.1 mm; ratio of length to cross sectional area 16.6 cm^{-1}; obtained by floating zone melting polycrystalline rod in a vacuum; electrical resistivity ratio $\rho(298K)/\rho_0$ = 47.0.

SPECIFICATION TABLE NO. 54 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
16	400	L	1953	0.60-0.86		Ta 1	99.98 pure; polycrystalline; effected by "frozen in" magnetic field; in superconducting state.
17	400	L	1953	0.79-1.0		Ta 1	Separate run of the above specimen; in superconducting state.
18	401	L	1959	4.4-114		Ta 3	99.9 pure; specimen consisted of four 1.5 mm wires supplied by Fansteel Metallurgy Corp; annealed in vacuum at 2500 C; ideal electrical resistivity reported as 0.0032, 0.017, 0.051, 0.12, 0.23, 0.54, 0.95, 1.43, 1.96, 2.50, 3.03, 3.65, 4.6, 5.6, 6.65, 7.65, 8.6, 9.6, 11.0, 12.1, and 13.1 μohm cm at 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 220, 250, 273, and 295 K, respectively; electrical resistivity ratio $\rho(295K)/\rho_0 = 62.1$.
19	412	L	1955	0.42-1.2		JM3804	99.98 pure; polycrystalline; in superconducting state.
20	501	L	1961	0.95-4.3			0.005 Fe, 0.003 Si, 0.0003 O, and 0.00025 H; single crystal; specimen obtained by floating-zone melting polycrystalline rod; electrical resistivity ratio $\rho(298K)/\rho_0 = 63$; measured in a magnetic field; in normal state.
21	501	L	1961	0.95-4.4			The above specimen in superconducting state.
22	501	L	1961	0.92-4.0			0.1 Nb, 0.01 C, 0.01 Fe, 0.01 Mo, 0.01 W, 0.001 O, 0.00075 N, and 0.00045 H; polycrystalline; electrical resistivity ratio $\rho(298K)/\rho_0 = 31$; measured in a magnetic field; in normal state; specimen same as that used by Rosenberg in 1955 (curve 7).
23	501	L	1961	1.0-4.3			The above specimen in superconducting state.
24	599	E	1961	299-1000		No. 9	99.9 pure; obtained from Fansteel Metallurgical Corp; density 16.4 g cm^{-3}; electrical resistivity reported as 15.1, 34.3, 35.0, 41.3, 48.2, and 49.8 μohm cm at 297, 670, 685, 840, 980, and 1000 K, respectively.
25	652	L, C	1961	323-523		JM 615	Spectrographically standardized tantalum; obtained from John Matthey and Co.; about 4.5 mm in dia and 10 cm long; electrical resistivity reported as 14.5, 15.45, 17.72, 22.25, and 24.4 μohm cm at 293, 323, 373, 473, and 523 K, respectively; Armco iron used as the comparative material.
26	709	E	1962	1233-2793			1 mm in dia, 30 mm long; electrical resistivity reported as 50, 73, 89, and 109 μohm cm at 900, 1500, 2000, and 2500 C, respectively.
27	654	P	1965	1460-2829	± 5		~99.89 Ta (by difference), < 0.1 Nb, < 0.01 C, and traces of other elements; 0.040 in. thick sheet; obtained from Murex Co.; vacuum beam melted; average grain size after testing 140 μ; density 16.6 g cm^{-3}; thermal conductivity values calculated from measured data of thermal diffusivity using the specific heat data of Kubaschewski, O. and Evans, L. Ll., (Metallurgical Thermochemistry, London, Pergamon, 1956).
28	24	E	1943	273, 373	10-90		99.9 pure; wire 0.01 in. in dia and ~15.7 in. long (40 cm); obtained from Fansteel Corp; electrical resistivity reported as 2.46, 12.41, and 17.18 μohm cm at 77.33, 273.2, and 373.4 K, respectively; measured in a vacuum of 10^{-6} mm Hg.

SPECIFICATION TABLE NO. 54 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
29	849	-	1966	1578-2007		No. 1	0.0019 C, 0.0017 H, 0.0017 N, and 0.0017 O; specimen 2.4892 cm in dia and 0.3927 cm thick; avg. grain size 0.26 mm; density 16.65 g cm^{-3}; thermal conductivity derived from the temp distribution on the flat surface of the cylindrical disc specimen heated in high vacuum (10^{-6} mm Hg) by high frequency induction.
30	849	-	1966	1700-2398		No. 2	0.0655 O, 0.0137 C, 0.0016 N, and 0.00027 H; machined from the same bar as the above specimen; 2.2232 cm in dia and 0.2125 cm thick; density 16.63 g cm^{-3}; measuring method same as above.
31	849	-	1966	1660-2490		No. 3	0.0114 O, 0.0016 N, 0.003 C, and 0.00027 H; machined from the same bar as the above specimen; 2.2232 cm in dia and 0.2018 cm thick; avg. grain size 1.04 mm dia; density 16.62 g cm^{-3}; measuring method same as above.
32	849	-	1966	1563-2142		No. 4	0.0036 O, 0.0018 N, 0.0009 H, and 0.00005 C; machined from the same bar as the above specimen; 1.9075 cm in dia and 0.2316 cm thick; avg. grain size 1.23 mm dia; density 16.63 g cm^{-3}; measuring method same as above.
33	313	T	1962	300-995			No details given for the specimen; thermal conductivity measured by the "small area contact method".

DATA TABLE NO. 54 THERMAL CONDUCTIVITY OF TANTALUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
841.5	0.676
1101.5	0.713
1378.7	0.746
1688.7	0.786
1819.8	0.782
CURVE 2	
290.2	0.544
373.2	0.540
CURVE 3	
1700	0.730
1900	0.780
2100	0.830
CURVE 4	
1665	0.601
1816	0.630
1923	0.616
2043	0.597*
2163	0.615
2260	0.610
2468	0.597
2524	0.605
2671	0.616
CURVE 5	
1.74	0.0160
1.88	0.0172
1.97	0.0180
2.08	0.0193
2.36	0.0220
2.52	0.0238
2.60	0.0260
2.82	0.0291
3.08	0.0331
3.27	0.0370
3.45	0.0396
3.60	0.0425
CURVE 5 (cont.)	
3.84	0.0450
4.03	0.0477
4.18	0.0500
CURVE 6	
1.70	0.0066
1.88	0.0080
1.98	0.0094
2.07	0.0102
2.40	0.0152
2.52	0.0178
2.70	0.0227
2.88	0.0265
3.10	0.0300
3.28	0.0330
3.46	0.0370
3.65	0.0410
3.85	0.0440
CURVE 7	
2.00	0.075
2.13	0.081
2.35	0.090
2.44	0.0925
2.54	0.0955
2.65	0.102
2.74	0.103
2.80	0.105
2.90	0.108
3.02	0.111
3.10	0.118
3.20	0.122
3.37	0.127
3.54	0.135
3.68	0.139
3.85	0.147
3.92	0.150
4.13	0.155
4.25	0.162
4.48	0.174
5.98	0.219
CURVE 7 (cont.)	
7.00	0.259
7.63	0.297
9.07	0.344
10.93	0.412
14.43	0.525
16.50	0.590
20.20	0.637
23.10	0.665
33.80	0.659
38.80	0.625
48.05	0.600
60.40	0.585
65.60	0.583
79.20	0.608
92.40	0.622
CURVE 8	
2.55	0.065
2.70	0.095
2.86	0.110
3.12	0.134
3.34	0.160
3.68	0.190
4.15	0.213
CURVE 9	
2.57	0.146
2.94	0.162
3.10	0.174
3.56	0.192
3.85	0.210
4.20	0.225
4.46	0.232
4.70	0.246
5.60	0.284
7.94	0.345
CURVE 10	
373.2	0.551
423.2	0.557
CURVE 10 (cont.)	
473.2	0.559
523.2	0.562
573.2	0.563
623.2	0.563
673.2	0.563
723.2	0.563
773.2	0.563
CURVE 11	
2343	0.533
2427	0.602
2587	0.543
2742	0.582
2743	0.519
2839	0.473
2860	0.450
3093	0.452
3148	0.450
CURVE 12	
2326	0.649
2563	0.538
2678	0.632
2811	0.613
2844	0.418
3071	0.467
CURVE 13	
2.26	0.0916
2.27	0.0886
2.58	0.0970
2.80	0.106
3.00	0.109
3.17	0.119
3.35	0.125
3.43	0.131
3.46	0.125
3.54	0.133
3.60	0.137
3.62	0.135
CURVE 13 (cont.)	
3.85	0.146
4.12	0.157
4.23	0.162
4.51	0.176
6.25	0.227
6.35	0.248
7.15	0.264
9.20	0.352
9.58	0.360
11.03	0.432
20.5	0.635
20.8	0.63
CURVE 14	
2.26	0.0426
2.35	0.0453
2.37	0.0474
2.38	0.0474
2.47	0.0518
2.56	0.0567
2.72	0.0663
2.90	0.0765
3.07	0.0862
3.21	0.0952
3.48	0.107
3.57	0.116
3.77	0.129
3.88	0.138
CURVE 15	
0.232	0.0018
0.246	0.00254
0.263	0.00273
0.270	0.0034
0.285	0.0037
0.31	0.0042
0.33	0.0055
0.34	0.0051
0.36	0.0066
0.37	0.0082
0.375	0.0090
CURVE 15 (cont.)	
0.38	0.0076
0.395	0.0085
0.40	0.0104
0.41	0.0095
0.43	0.0114
0.45	0.0151
0.47	0.0132
0.485	0.0146
0.50	0.021
0.52	0.0215
0.54	0.029
0.55	0.0235
0.60	0.029
0.61	0.038
0.63	0.037
0.68	0.049
0.70	0.068
0.73	0.081
0.77	0.0805
0.78	0.088
0.84	0.091
0.85	0.104
0.94	0.10
0.95	0.108
1.04	0.11
1.08	0.096
1.15	0.080
CURVE 16	
0.60	0.00215
0.62	0.00232
0.65	0.00240
0.66	0.00260
0.68	0.00270
0.71	0.00282
0.725	0.00294
0.75	0.00315
0.78	0.00342
0.82	0.00380
0.86	0.00395
CURVE 17	
0.79	0.0015
0.825	0.00152
0.85	0.00168
0.865	0.00175
0.90	0.00190
0.925	0.00210
0.952	0.00232
0.98	0.00245
0.995	0.0025
CURVE 18	
4.41	0.495
5.64	0.632
6.65	0.743
7.71	0.862
8.62	0.947
9.57	1.09
11.3	1.24
13.6	1.35
15.7	1.44
18.4	1.45
22.0	1.41
25.9	1.28
30.0	1.16
33.6	1.03
37.7	0.919
42.2	0.848
59.4	0.646
70.7	0.589
78.0	0.605
80.0	0.600
90.6	0.595
91.8	0.600
114.1	0.587
CURVE 19	
0.42	0.00183
0.505	0.00268
0.57	0.0034
0.58	0.0036
0.605	0.0041

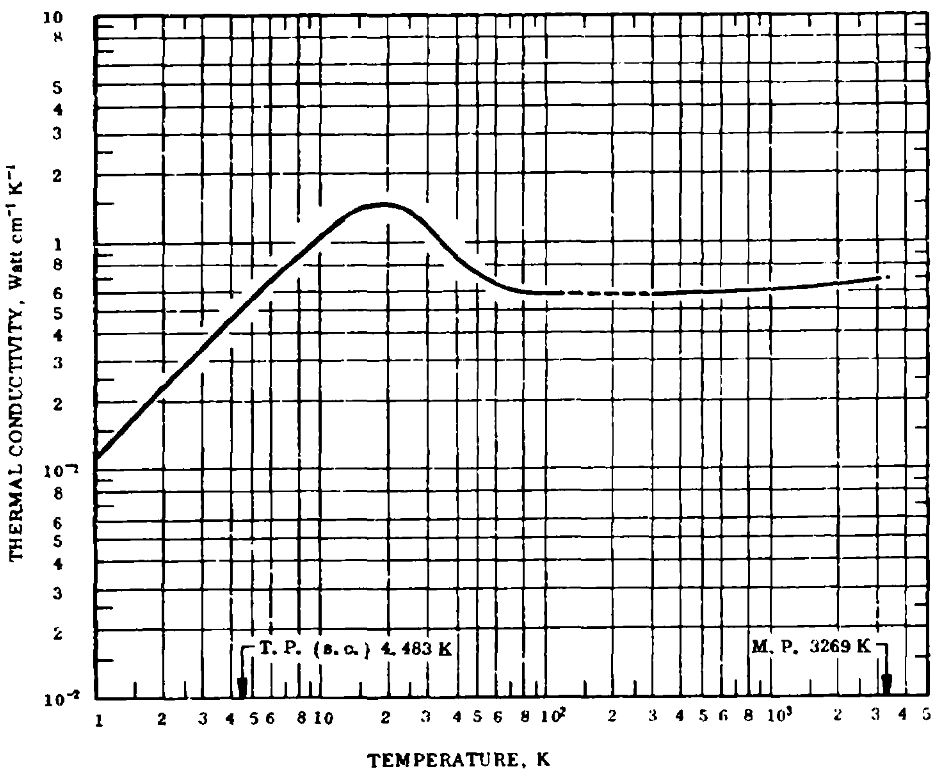
*Not shown on plot

DATA TABLE NO. 54 (continued)

T	k
CURVE 19 (cont.)	
0.665	0.00405
0.670	0.0051
0.705	0.00505
0.710	0.0052
0.710	0.0055
0.796	0.0061
0.80	0.00645
0.83	0.0066
0.91	0.00895
1.16	0.0130
CURVE 20	
0.95	0.0783
1.20	0.0995
1.51	0.124
1.58	0.129
1.76	0.143
2.02	0.162
2.20	0.182
2.50	0.200
2.82	0.227
3.12	0.252
3.40	0.270
3.57	0.287
3.71	0.300
4.01	0.328
4.26	0.357
CURVE 21	
0.95	0.102
1.05	0.0832
1.15	0.0628
1.20	0.0581
1.30	0.0500
1.44	0.0418
1.63	0.0440
1.83	0.0521
2.00	0.0535
2.22	0.0783
2.50	0.111
2.75	0.142
2.95	0.168
3.05	0.187
3.28	0.210
CURVE 21 (cont.)	
3.51	0.240
3.72	0.270
3.84	0.283
4.12	0.330
4.30	0.350
4.40	0.368
CURVE 22	
0.92	0.0370
1.12	0.0450
1.85	0.0750
2.02	0.0850
2.50	0.100
2.85	0.114
3.25	0.180
3.65	0.195
4.01	0.212
CURVE 23	
1.00	0.0100
1.13	0.0110
1.35	0.0125
1.76	0.0217
1.91	0.0260
2.06	0.0331
2.20	0.0410
2.52	0.0562
2.82	0.0755
3.06	0.0890
3.28	0.100
3.61	0.122
4.05	0.152
4.16	0.160
4.34	0.174
CURVE 24	
299	0.542
670	0.661
686	0.621
845	0.680
986	0.709
1600	0.728
CURVE 25	
323.2	0.582
373.2	0.585
473.2	0.585
523.2	0.582
CURVE 26	
1233.2	0.444
1293.2	0.487
1323.2	0.460
1433.2	0.462
1433.2	0.418
1513.2	0.452
1633.2	0.423
1738.2	0.444
1893.2	0.404
1953.2	0.439
2033.2	0.356
2093.2	0.423
2153.2	0.339
2273.2	0.402
2273.2	0.385
2373.2	0.410
2443.2	0.379
2493.2	0.310
2618.2	0.410
2688.2	0.335
2793.2	0.331
CURVE 27	
1460	0.627
1500	0.630
1600	0.637
1700	0.644
1800	0.651
1900	0.659
2000	0.666
2100	0.673
2200	0.681
2300	0.688
2400	0.695
2500	0.703
2600	0.710
2700	0.717
2820	0.726
CURVE 28	
273.2	0.36
373.4	0.19
CURVE 29	
1578	0.617
1746	0.584
1841	0.590
1942	0.597
2007	0.606
CURVE 30	
1700	0.691
1759	0.678
1869	0.693
1985	0.675
2225	0.643
2334	0.627
2398	0.603
CURVE 31	
1660	0.703
1828	0.680
2043	0.598
2269	0.680
2391	0.567
2490	0.574
CURVE 32	
1563	0.603
1585	0.640
1712	0.665
1714	0.668
1811	0.621
1907	0.667
2020	0.613
2142	0.707
CURVE 33	
300	0.493
670	0.577
684	0.554
CURVE 33 (cont.)	
845	0.613
988	0.643
995	0.652

* Not shown on plot

FIGURE AND TABLE NO. 54R RECOMMENDED THERMAL CONDUCTIVITY OF TANTALUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.582	33.6	440.3
1	0.115	6.64	-457.9	600	0.586	33.9	620.3
2	0.230	13.3	-456.1	700	0.590	34.1	800.3
3	0.345	19.9	-454.3	800	0.594	34.3	980.3
4	0.459	26.5	-452.5	900	0.598	34.6	1160
5	0.571	33.0	-450.7	1000	0.602	34.8	1340
6	0.681	39.3	-448.9	1100	0.606	35.0	1520
7	0.788	45.5	-447.1	1200	0.610	35.2	1700
8	0.891	51.5	-445.3	1300	0.614	35.5	1880
9	0.989	57.1	-443.5	1400	0.618	35.7	2060
10	1.08	62.4	-441.7	1500	0.622	35.9	2240
11	1.16	67.0	-439.7	1600	0.626	36.2	2420
12	1.24	71.6	-438.1	1700	0.630	36.4	2600
13	1.30	75.1	-436.3	1800	0.634	36.6	2780
14	1.36	78.6	-434.5	1900	0.637	36.8	2960
15	1.40	80.9	-432.7	2000	0.640	37.0	3140
16	1.44	83.2	-430.9	2200	0.647	37.4	3500
18	1.47	84.9	-427.3	2400	0.653	37.7	3860
20	1.47	84.9	-423.7	2600	0.658	38.0	4220
25	1.36	78.6	-414.7	2800	0.663	38.3	4580
30	1.16	67.0	-405.7	3000	0.665	38.4	4940
35	0.99	57.2	-396.7	3200	(0.666)	(38.5)	5300
40	0.87	50.3	-387.7				
45	0.78	45.1	-378.7				
50	0.72	41.6	-369.7				
60	0.651	37.6	-351.7				
70	0.616	35.6	-333.7				
80	0.603	34.8	-315.7				
90	0.596	34.4	-297.7				
100	0.592	34.2	-279.7				
150	(0.580)‡	(33.5)	-189.7				
200	(0.575)	(33.2)	- 99.7				
250	(0.574)	(33.2)	- 9.7				
273.2	(0.574)	(33.2)	32.0				
300	0.575	33.2	80.3				
350	0.576	33.3	170.3				
400	0.578	33.4	260.3				

REMARKS

The recommended values are for well-annealed 99.9⁺% pure tantalum with residual electrical resistivity ρ_0 = 0.212 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 150 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.10, α' = 4.52 x 10^{-4}, and β = 6.69. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature, and 5 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or interpolated.

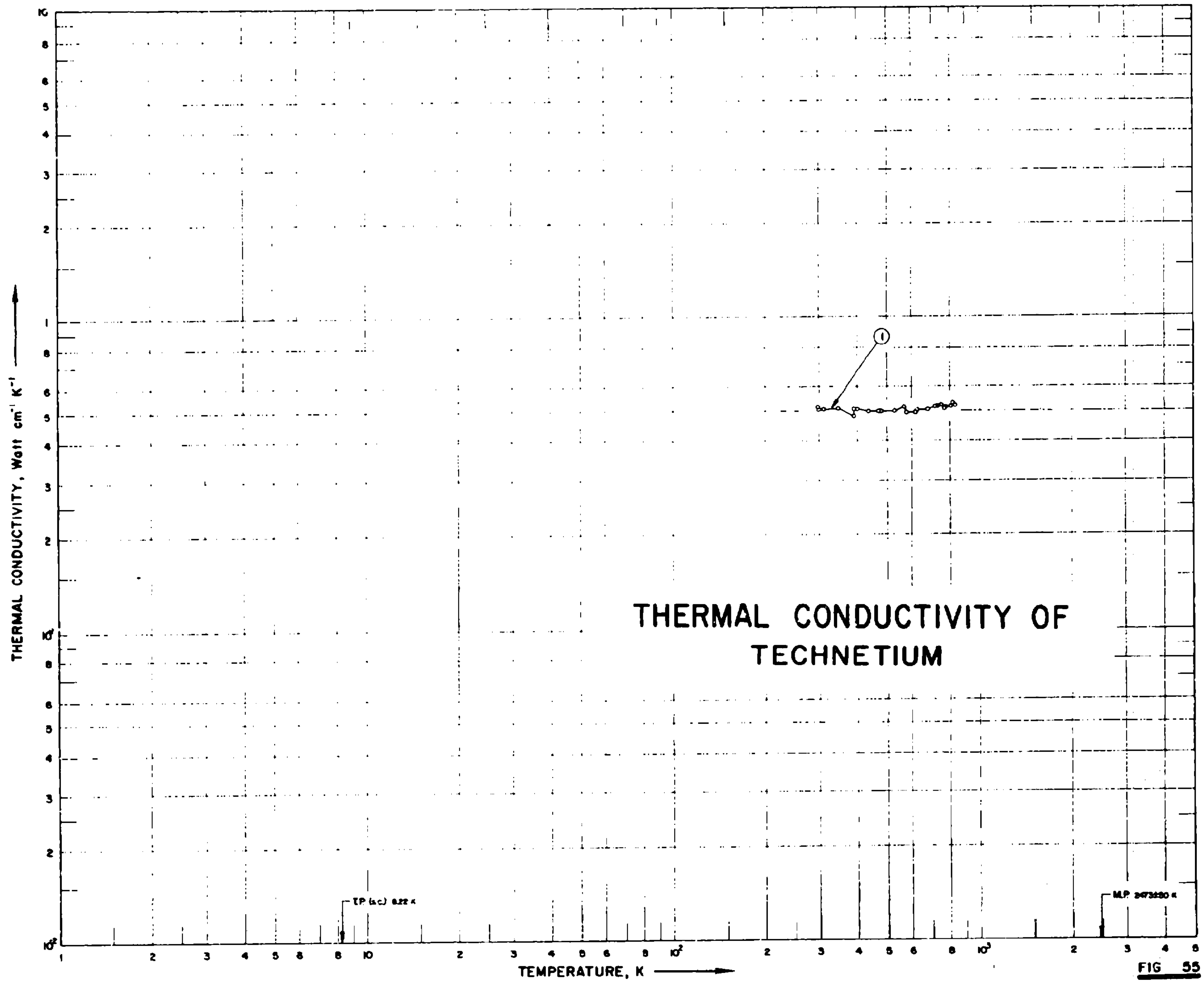

THERMAL CONDUCTIVITY OF TECHNETIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P. (s.c.) 8.22 K
M.P. 2473±50 K
1

FIG 55

SPECIFICATION TABLE NO. 55 THERMAL CONDUCTIVITY OF TECHNETIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 55]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	830	P	1965	298-838			Total impurities ~0.0150; specimen ~0.12 cm thick and 2.3 cm in dia; prepared from reduced metal recovered from fission product wastes; the material melted in an electron beam evaporator, heated to 1540 C by induction, press forged, and ground to final shape; thermal conductivity values calculated from measured data of thermal diffusivity, the measured density (11.492 g cm^{-3}), and the heat capacity data taken from Stull, D.R. and Sinke, G.C. (Thermodynamic Properties of the Elements, American Chemical Soc., Washington, D.C., pp. 198-9, 1956).

DATA TABLE NO. 55 THERMAL CONDUCTIVITY OF TECHNETIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
298	0.515
301	0.502
311	0.504
318	0.510
391	0.481
391	0.506
401	0.506
438	0.498
471	0.498
481	0.498
531	0.498
571	0.515
581	0.494
621	0.494
628	0.502
678	0.510
683	0.502
718	0.519
733	0.519
751	0.523
771	0.506
781	0.515
808	0.519
823	0.531
833	0.523*
838	0.523

* Not shown on plot

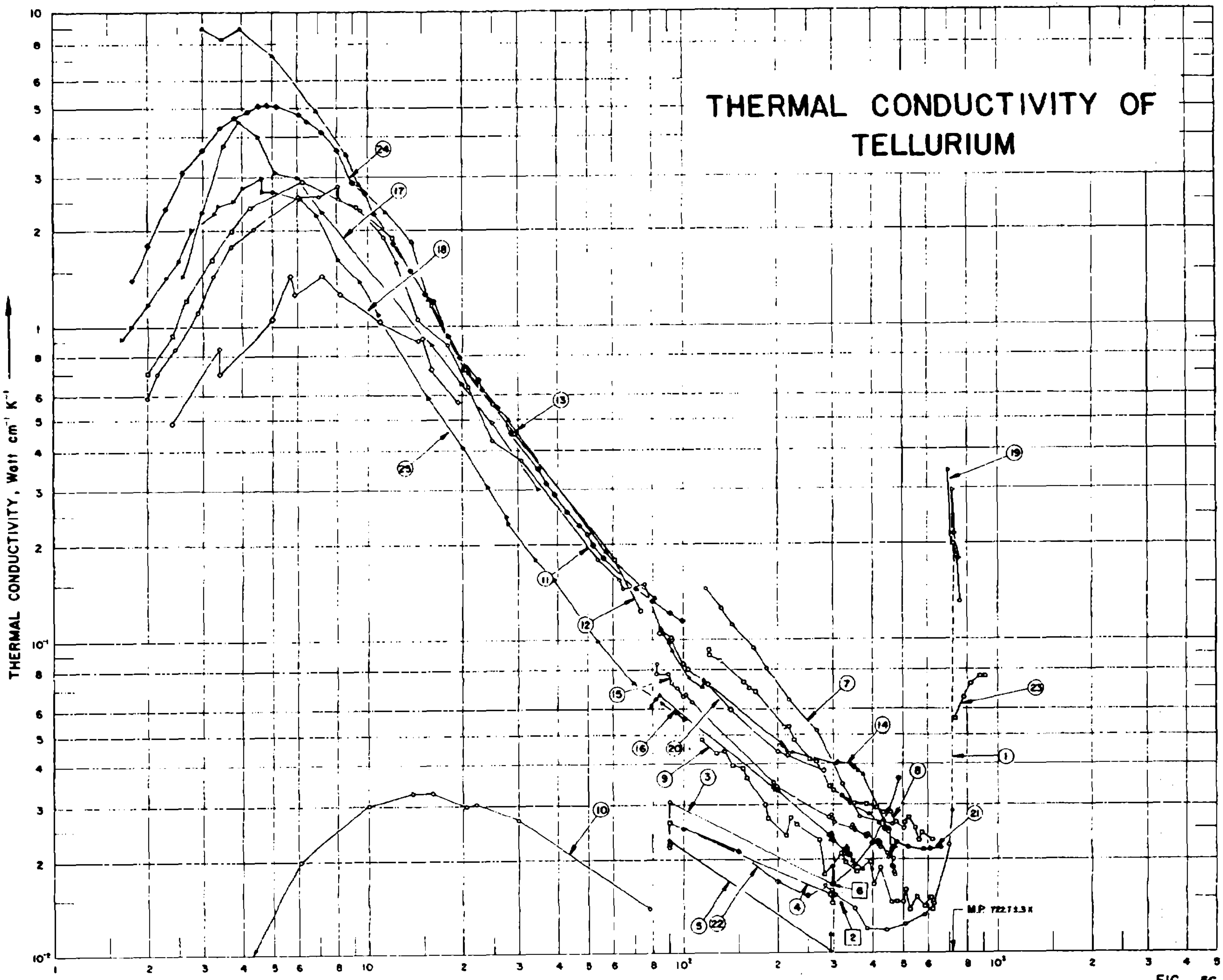

THERMAL CONDUCTIVITY OF TELLURIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 722.7±3 K

FIG 56

SPECIFICATION TABLE NO. 56 THERMAL CONDUCTIVITY OF TELLURIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 56]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	297	L	1957	285-763	1-5		Spectrally pure; polycrystalline; bar specimen prepared by triple fractional distillation in a vacuum of 10^{-4} mm Hg, cold pressing under 4000 kg cm^{-2}, and hot pressing at 673 K under 380 kg cm^{-2} for 6 hrs; melting point 452 C; measured in both solid and liquid states.
2	366	P	1916	318.5			Material supplied by Eimer and Amend; melted and cast in a hydrogen atmosphere; density 6.25 g cm^{-3}; thermal conductivity value calculated from measured thermal diffusivity using specific heat value taken from literature.
3	367	L	1933	90-298			<0.01 impurities; single crystal; electrical resistivity reported as 0.021 and 0.035 ohm cm at 90 and 298 K, respectively; heat flow parallel to crystal axis.
4	367	L	1933	90-299			<0.01 impurities; polycrystalline; cast; electrical resistivity 0.030 ohm cm at 296 K.
5	367	L	1933	90-296			<0.01 impurities; polycrystalline; cast; electrical resistivity 0.200 ohm cm at 296 K.
6	368	L, C	1954	298.2	0.2-3		15 mm dia disk; electrical resistivity reported as 0.235 ohm cm at 298 K; concentration of current carriers = 3.46×10^{16} cm^{-3}.
7	369		1959	118-462		1	Single crystal; tempered in vacuum for 24 hrs at 673 K; heat flow parallel to principal crystal axis.
8	369		1959	122-622		2	Single crystal; heat flow parallel to principal crystal axis.
9	369		1959	115-622		3	Single crystal; heat flow perpendicular to principal crystal axis.
10	370	L	1957	2.0-78		Te 1	~99.5 pure; polycrystalline; 5 mm dia, 1.5 cm long; broken from a longer rod; supplied by Messrs. A.D. MacKay, Inc.
11	370	L	1957	2.0-92		Te 2	99.99 pure; polycrystalline; individual crystals 1 or 2 mm wide and up to 1 cm long; specimen 3 mm in dia, ~5 cm long, fabricated from pure crystalline lump supplied by Messrs. A.D. MacKay, Inc., zone refined, etched, melted under vacuum in Pyrex tube and allowed to recrystallize.
12	370	L	1957	2.0-74		Te 3	Similar to above but the specimen composed of only 5 or 6 crystals of larger size.
13	370	L	1957	3.0-82		Te 5	The above specimen annealed for about 5 days at a temp just below the melting point, then cooled slowly for 24 hrs to produce a single crystal; crystallographic axis at about 80° to the axis of cylindrical specimen.
14	371	L	1959	85-472		I	Single crystal; 0.72 x 1.06 x 1.95 cm; hole concentration 1×10^{18} cm^{-3}; heat flow in direction of main crystallographic axis.
15	371	L	1959	83-471		II	Single crystal; 0.48 x 0.84 x 1.67 cm; prepared by recrystallization of Te distilled two or three times, slow cooling in a sealed evacuated ampule made of high melting-point glass; hole concentration 9×10^{16} cm^{-3}; heat flow in direction of main crystallographic axis.
16	371	L	1959	80-373		III	Sb-doped; single crystal; 0.77 x 0.80 x 2.03 cm; prepared in same manner as the above specimen, except some antimony added to the twice-distilled tellurium; hole concentration 5×10^{18} cm^{-3}.

SPECIFICATION TABLE NO. 56 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
17	801	L	1962	2.6-35		No. 1	Single crystal; 28 x 0.31 x 0.3 cm; specimen axis along principal crystal axis; prepared by zone melting; annealed for 70 hrs at 593 K, etched in SR-4; carrier concentration 3×10^{14} cm^{-3} at 77 K.
18	801	L	1962	2.4-20		No. 2	Single crystal; 17 x 0.36 x 0.33 cm; specimen axis along principal crystal axis; prepared by zone melting; etched in HNO_3; carrier concentration 7×10^{14} cm^{-3} at 77 K.
19	802	-	1962	696-750			Pure; liquid specimen contained in a sealed Pyrex glass vessel; electrical resistivity reported as 0.77, 0.68, 0.58, 0.49, 0.48, 0.45, 0.44, and 0.41 milliohm cm at 394, 404, 433, 469, 472, 496, 502, and 528 C, respectively; data corrected for conduction of heat through the current lead.
20	803	L	1963	84-280	5-8	No. 1	Single crystal; specimen cut from single crystal ingot obtained by slow cooling of molten tellurium in a sealed evacuated ampoule; annealed in sealed ampoule for 90 hrs at 613 K; hole concentration ~2×10^{15} cm^{-3} at 80 K; measured under atm. of argon, with heat flow along the c-axis.
21	803	C	1963	320-660	5-8	No. 1	The above specimen measured by a comparative method using fused quartz as comparative material.
22	804	C	1961	100-485			99.6 pure; polycrystalline; specimen 0.3 cm long and 0.5 cm in dia; hole concentration 3×10^{16} cm^{-3} (as calculated from Hall effect); brass (38.5 Zn, 61.5 Cu) used as comparative material; data taken from smoothed curve of 4 measurements.
23	914	L	1966	743-823			99.995 pure; molten specimen contained in a short cylindrical cell.
24	961	L	1967	1.8-98			Single crystal; specimen 2.09 mm^2 in cross section and 1.45 mm long; heat flow parallel to the c-axis; (additional information and the tabulated data obtained from author).
25	961	L	1967	1.7-101			Single crystal; specimen 2.418 mm^2 in cross section and 1.55 mm long; heat flow perpendicular to the c-axis; (additional information and the tabulated data obtained from author).

DATA TABLE NO. 56 THERMAL CONDUCTIVITY OF TELLURIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K, Thermal Conductivity, K, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
284.60	0.0163
306.40	0.0154
350.10	0.0138
384.40	0.0121
444.60	0.0118
509.00	0.0124
583.90	0.0133
628.50	0.0144
701.50	0.0221
721.20	0.0287
731.00	0.199
740.90	0.184
763.00	0.130
CURVE 2	
318.50	0.0145
CURVE 3	
90.00	0.0219
93.00	0.0308
298.00	0.0167
298.00	0.0192
CURVE 4	
90.00	0.0222
50.00	0.0263
296.00	0.0134
298.00	0.0145
299.00	0.0158
CURVE 5	
90.00	0.0230
295.00	0.0102
296.00	0.0116
CURVE 6	
298.2	0.0167

T	k
CURVE 7	
118.0	0.145
133.0	0.125
144.0	0.112
168.0	0.0946
186.0	0.0812
218.0	0.0640
267.0	0.0515
323.0	0.0347
364.0	0.0276
462.0	0.0259
CURVE 8	
122.0	0.0933
123.0	0.0895
132.0	0.0858
157.0	0.0736
163.0	0.0703
170.0	0.0682
212.0	0.0531
218.0	0.0531
226.0	0.0481
253.0	0.0418
266.0	0.0410
293.0	0.0343
300.0	0.0335
349.0	0.0305
383.0	0.0301
413.0	0.0293
433.0	0.0285
456.0	0.0285
475.0	0.0264
503.0	0.0251
507.0	0.0264
522.0	0.0272
549.0	0.0251
567.0	0.0230
575.0	0.0243
622.0	0.0230

T	k
CURVE 9	
115.0	0.0485
128.0	0.0439
136.0	0.0444
144.0	0.0397
156.0	0.0383
160.0	0.0364
183.0	0.0301
187.0	0.0272
214.0	0.0238
221.0	0.0272
230.0	0.0259
273.0	0.0230
282.0	0.0180
319.0	0.0209
328.0	0.0197
356.0	0.0184
392.0	0.0197
405.0	0.0167
424.0	0.0188
460.0	0.0146
483.0	0.0146
503.0	0.0146
514.0	0.0159
525.0	0.0138
555.0	0.0151
586.0	0.0142
619.0	0.0151
622.0	0.0138
CURVE 10	
2.0	0.0017
2.5	0.00204
3.25	0.00502
4.05	0.009
6.1	0.02
10.0	0.0303
13.8	0.033
16.0	0.033
20.5	0.03
22.0	0.0305
30.0	0.027
78.0	0.014

T	k
CURVE 11	
2.0	0.59
2.15	0.70
2.45	0.85
2.9	1.19
3.25	1.45
3.7	1.80
4.38	2.02
6.05	2.6
7.0	2.6
8.05	2.8
8.10	2.56
9.5	2.35
11.3	1.9
12.4	1.6
14.5	1.05
18.0	0.87
21.0	0.635
25.0	0.43
31.0	0.37
54.0	0.18
63.0	0.155
65.0	0.145
76.0	0.15
85.0	0.108
92.0	0.102
CURVE 12	
2.0	0.705
2.4	0.945
2.65	1.20
3.2	1.65
3.7	2.0
4.25	2.4
6.2	2.9
9.2	2.4
12.0	1.9
16.0	1.15
20.5	0.72
25.0	0.56
29.4	0.45
61.0	0.18
74.0	0.123

T	k
CURVE 13	
3.0	9.0
3.45	9.35
3.95	9.0
5.0	7.3
6.85	4.9
8.6	3.5
9.35	2.65
11.5	2.3
13.8	1.85
15.7	1.2
21.0	0.7
28.0	0.498
57.0	0.19
81.5	0.135
CURVE 14	
85	0.108
90	0.0983
92.5	0.0929
105	0.0761
107	0.0791*
116	0.0711
117	0.0749
205	0.0469
207.5	0.0464
210.0	0.0460
215	0.0444
224	0.0439
305	0.0400
310	0.0408
345	0.0398
350	0.0394
355	0.0389
362.5	0.0380
375	0.0372
435	0.0267
440	0.0254
446	0.0252
454	0.0249
460	0.0212
460	0.0217
465	0.0217
472	0.0219

T	k
CURVE 15	
83	0.0837
83	0.0778
90	0.0778
92	0.0728
96	0.0699
100	0.0657
102.5	0.0669
107.5	0.0636
195	0.0349
200	0.0341
291	0.0272
297.5	0.0277
298.5	0.0268
303	0.0272
344	0.0252
346	0.0256
350	0.0251
353	0.0248
380	0.0238
383	0.0236
386	0.0241
413	0.0226
418	0.0228
419	0.0222
422	0.0219
425	0.0223
445	0.0209
447.5	0.0204
452.5	0.0207
460	0.0190
466	0.0202
466	0.0189
470	0.0181
471	0.0178
CURVE 16	
79.5	0.0619
82	0.0644
84	0.0665
195	0.0337
196	0.0332
201.5	0.0332

T	k
CURVE 16 (cont.)	
293	0.0239
295	0.0230
297.5	0.0237
297.5	0.0243*
302.5	0.0228
327.5	0.0213
332.5	0.0208
332.5	0.0218
337.5	0.0207
340	0.0207
345	0.0199
372.5	0.0187
CURVE 17	
2.6	1.45
3.0	2.30
3.5	3.75
3.9	4.5
4.5	4.0
5.1	3.1
6.0	3.0
7.2	2.30
16.0	0.87
20.0	0.65
25.0	0.49
35	0.30
CURVE 18	
2.4	0.49
3.4	0.85
3.4	0.70
5.0	1.05
5.7	1.45
5.9	1.25
7.2	1.45
8.2	1.25
11	1.02
14.5	0.90
15	0.92
16	0.72
19.5	0.57

*Not shown on plot

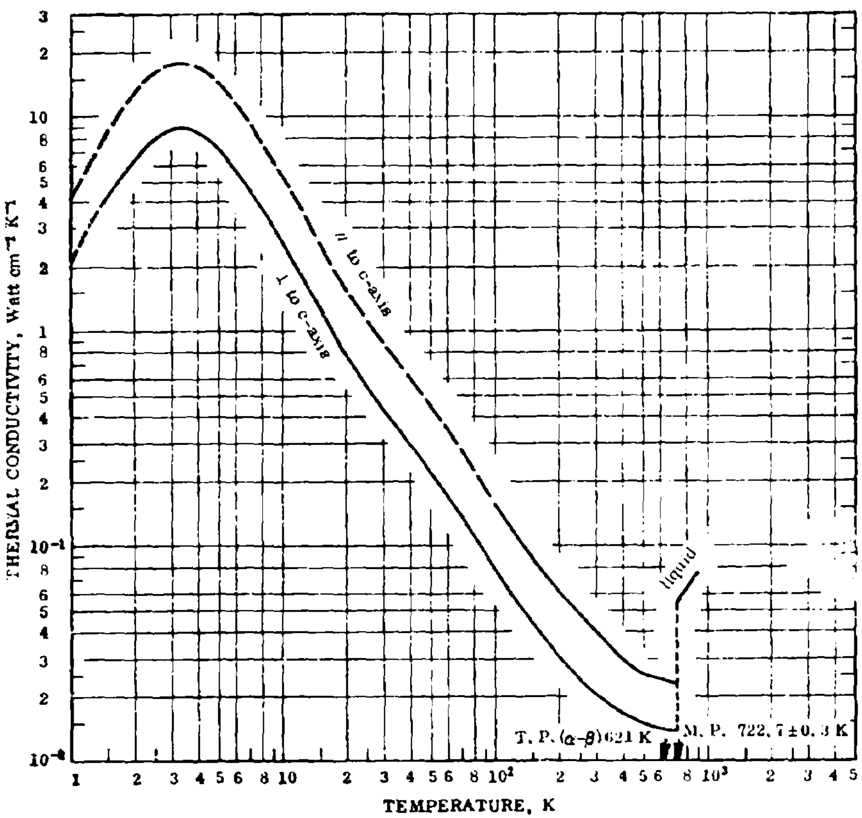
DATA TABLE NO. 56 (continued)

T	k
CURVE 19	
696.2	0.340
710.2	0.2150
723.2	0.200
723.2	0.295
723.2	0.215
750.2	0.180
CURVE 20	
84	0.105
92	0.0996
100	0.0837
104	0.0805
120	0.0721
142	0.0598
200	0.0440
215	0.0427
230	0.0380
CURVE 21	
320	0.0322
340	0.0305
390	0.0279
420	0.0262
440	0.0249
480	0.0226
520	0.0218
580	0.0215
610	0.0215
660	0.0218
CURVE 22	
100	0.0251
150	0.0213
200	0.0169
250	0.0153
300	0.0167
350	0.0192
400	0.0226
450	0.0285
485	0.0359

T	k
CURVE 23	
743	0.056
793	0.065
833	0.072
892	0.076
923	0.076
CURVE 24	
1.78	1.42
1.98	1.82
2.27	2.38
2.58	3.10
2.97	3.64
3.40	4.35
3.75	4.68
4.20	4.89
4.60	5.07
4.89	5.12
5.10	5.08
5.25	5.02
6.02	4.78
6.09	4.79
6.52	4.51
7.12	4.14
8.10	3.62
9.04	2.88
10.8	2.25
12.1	1.81
13.6	1.48
15.1	1.26
16.2	1.16
18.1	0.93
20.8	0.78
22.5	0.65
22.8	0.62
25.3	0.54
28.5	0.445
34.3	0.337
36.6	0.31
39.3	0.287
42.8	0.255
47.1	0.225
49.3	0.216
52.5	0.196
55.6	0.177
71.2	0.143

T	k
CURVE 24 (cont.)	
79.9	0.133
90.8	0.119
98.3	0.114
CURVE 25	
1.66	0.918
1.82	1.04
1.99	1.19
2.28	1.45
2.5	1.65
2.78	2.0
3.25	2.3
3.38	2.45
3.75	2.55
4.05	2.8
4.60	2.75
4.65	3.05
5.1	2.65
6.1	2.55
6.95	2.22
8.1	1.63
9.55	1.38
10.1	1.06
13.3	0.77
15.6	0.58
18.0	0.480
20.3	0.405
24.1	0.295
28.2	0.235
28.2	0.245
34.3	0.178
39.1	0.153
45.4	0.123
52.5	0.095
70.2	0.073
84.9	0.062
95.0	0.059
101.0	0.057

FIGURE AND TABLE NO. 56R RECOMMENDED THERMAL CONDUCTIVITY OF TELLURIUM



RECOMMENDED VALUES*

Single Crystal

T_1	k_1 (// to c-axis)	k_2 (// to c-axis)	k_1 (⊥ to c-axis)	k_2 (⊥ to c-axis)	T_2
0	0	0	0	0	-459.7
1	(4.02)‡	(232)	(2.01)	(116)	-457.9
2	(12.7)	(734)	6.33	366	-456.1
3	(17.5)	(1010)	8.76	506	-454.3
4	(17.2)	(994)	8.62	498	-452.5
5	(14.4)	(832)	7.18	415	-450.7
6	(11.7)	(676)	5.83	337	-448.9
8	(7.76)	(448)	3.88	224	-445.3
10	(5.36)	(310)	2.68	155	-441.7
15	(2.56)	(148)	1.28	74.0	-432.7
20	(1.55)	(89.6)	0.776	44.8	-423.7
25	(1.13)	(65.3)	0.566	32.7	-414.7
30	(0.886)	(51.2)	0.443	25.6	-405.7
35	(0.732)	(41.9)	0.363	21.9	-396.7
40	(0.610)	(35.2)	0.305	17.6	-387.7
50	(0.454)	(26.2)	0.227	13.1	-369.7
60	(0.348)	(20.1)	0.174	10.1	-351.7
70	(0.276)	(15.9)	0.138	7.97	-333.7
80	(0.224)	(12.9)	0.112	6.47	-315.7
90	(0.187)	(10.8)	0.0937	5.41	-297.7
100	(0.159)	(9.19)	0.0795	4.59	-279.7
150	0.0893	5.16	0.0448	2.59	-189.7
200	0.0615	3.55	0.0311	1.80	- 99.7
250	0.0491	2.84	0.0246	1.42	- 9.7
273.2	0.0442	2.55	0.0226	1.31	32.0
300	0.0396	2.29	0.0208	1.20	80.3
350	0.0336	1.94	0.0185	1.07	170.3
400	0.0294	1.70	0.0169	0.976	260.3
500	0.0251	1.45	0.0151	0.872	440.3
600	0.0240	1.39	0.0143	0.826	620.3
700	0.0230	1.33	0.0140	0.809	800.3
722.7	0.0229	1.32	0.0140	0.809	841.2

In Liquid State

T_1	k_1	k_2	T_2
722.7	0.0545	3.15	841.2
800	0.0662	3.83	980.3
900	0.0759	4.39	1160

REMARKS

The recommended values are for 99.99+% pure tellurium. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures above 10 K. The thermal conductivity near and below the corresponding temperature of its maximum is highly sensitive to small physical and chemical variations of the specimens, and the values below 10 K are intended as typical values for indicating the general trend.

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* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or estimated.

THERMAL CONDUCTIVITY OF TERBIUM

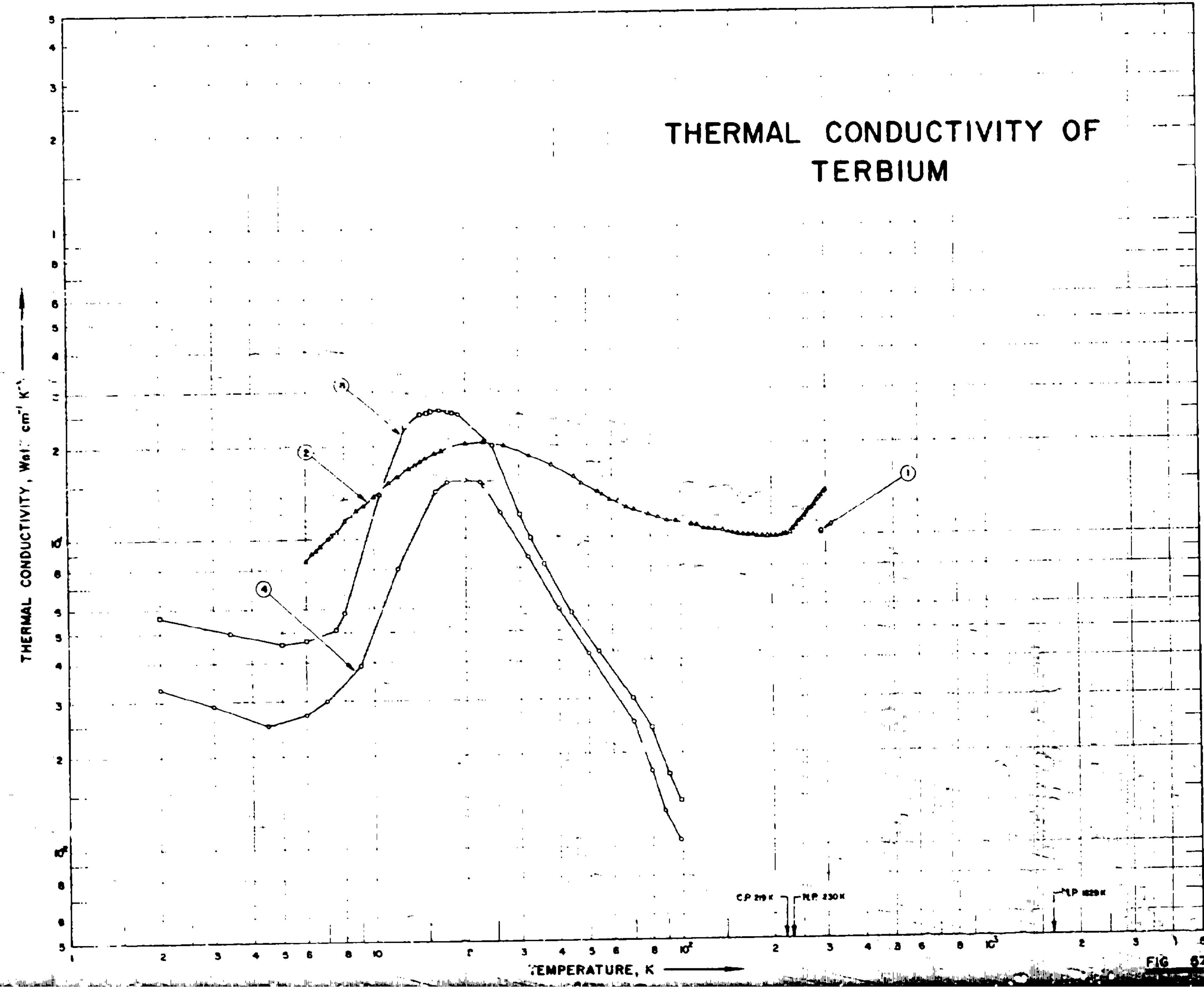


FIG. 67

SPECIFICATION TABLE NO. 57 THERMAL CONDUCTIVITY OF TERBIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 57]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	777	C	1965	291.2	±3.0		High purity; polycrystalline; specimen 0.25 in. in dia and 0.25 in. long; supplied by Johnson Matthey Co.; electrical resistivity reported as 119 μohm cm at about 18 C; monel metal used as comparative material; measurements made using 2 different thermel comparators.
2	816	L	1964	6.0-300			0.08 O, 0.06 Y, 0.01 Cu, 0.01 Si, and 0.003 Mg; polycrystalline; specimen 0.476 cm in dia and 6 cm long; supplied by Research Chemicals; arc-melted for 12 min, machined, swaged, heated in vacuum of 10^{-5} mm Hg at 790 K for 40 hrs and cooled to room temp in about 3 hrs; measured in vacuum of 6 x 10^{-6} mm Hg; electrical resistivity reported as 4.851, 5.006, 5.843, 7.041, 11.196, 14.998, 19.637, 23.504, 28.815, 41.320, 57.922, 85.109, 105.708, 112.480, 116.077, 117.000, 119.308, 121.842, and 123.686 μohm cm at 4.18, 12.62, 20.09, 25.37, 37.21, 45.71, 55.37, 63.13, 73.61, 97.72, 128.29, 175.61, 212.73, 223.27, 231.13, 241.45, 264.35, 287.39, and 303.59 K, respectively; ferromagnetic-antiferromagnetic and antiferromagnetic-paramagnetic transition occurred at 219 K and 230 K respectively.
3	814		1966	2.0-99		Tb 1	99.9 pure; specimen 0.25 mm in dia; baked for 1.5 hrs at 650 C; measured in helium atmosphere; electrical resistivity 4.13 μohm cm at 4.2 K; electrical resistivity ratio $\rho(293K)/\rho(4.2K)$ = 30; data taken from smoothed curve.
4	814		1966	2.0-99		Tb 2	99.9 pure; specimen 0.25 mm in dia; baked for 1.5 hrs at 650 C; measured in helium atmosphere; electrical resistivity 7.90 μohm cm at 4.2 K; electrical resistivity ratio $\rho(293K)/\rho(4.2K)$ = 15.6; data taken from smoothed curve.

DATA TABLE NO. 57 THERMAL CONDUCTIVITY OF TERBIUM

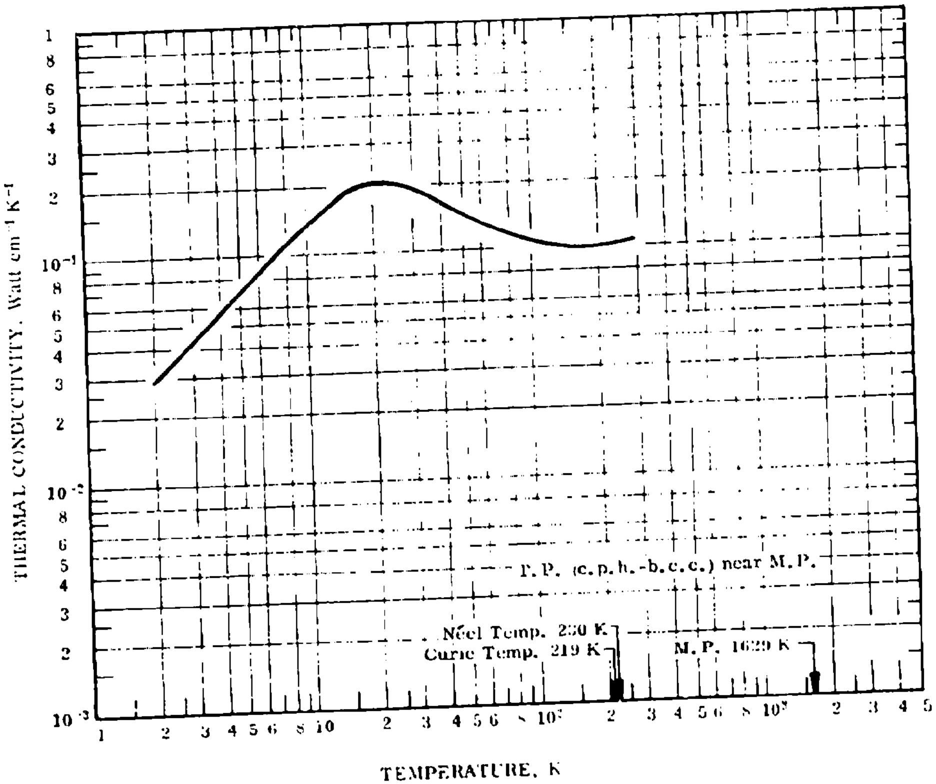
(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k	T	k	T	k
CURVE 1		CURVE 2 (cont.)		CURVE 2 (cont.)		CURVE 3 (cont.)	
291.2	0.102	79.7	0.118	235.2	0.105	69.5	0.03
291.2	0.105	85.8	0.116	236.0	0.105	80.0	0.024
		91.0	0.113	240.2	0.107	91.0	0.017
CURVE 2		97.7	0.112	245.1	0.110	99.4	0.014
6.02	0.0854	103.5	0.111	250.1	0.112		
6.28	0.0900	109.0	0.109	251.0	0.113	CURVE 4	
6.48	0.0912	111.6	0.108	255.0	0.115		
6.68	0.0949	114.5	0.108	255.7	0.115*	2.0	0.033
7.11	0.101	120.6	0.106	260.6	0.118	3.0	0.029
7.25	0.103	126.6	0.105	265.6	0.121	4.5	0.025
7.56	0.106	131.9	0.105	270.5	0.123	6.0	0.027
7.66	0.107*	138.2	0.104	275.5	0.126	7.0	0.030
8.02	0.114	144.1	0.103	280.4	0.129	9.0	0.039
8.36	0.119	149.7	0.102	285.3	0.132	12.0	0.080
8.79	0.124	156.1	0.101	290.2	0.134	16.0	0.143
9.26	0.128	162.2	0.101	295.1	0.137	17.5	0.153
10.0	0.137	168.2	0.100	300.0	0.139	20.0	0.155
10.6	0.145	174.3	0.100			22.5	0.152
11.3	0.153	180.4	0.0998	CURVE 3		23.0	0.148
12.0	0.159	181.9	0.0994			26	0.121
13.2	0.169	183.1	0.0998*	2.0	0.0565	32	0.087
13.7	0.173	184.3	0.0997	3.4	0.050	40	0.059
14.2	0.177	185.7	0.0994	5.0	0.046	50	0.042
14.8	0.182	187.4	0.0997	6.0	0.047	70	0.025
15.1	0.183*	194.0	0.0994	7.5	0.051	80	0.0175
15.9	0.189	198.5	0.0999	8.0	0.058	88	0.013
16.7	0.193	206.3	0.0996	10.5	0.140	99	0.0105
18.0	0.200	212.5	0.0999	12.7	0.230		
20.1	0.203	213.7	0.100	14.3	0.250		
22.9	0.205	214.0	0.100*	15.0	0.253		
26.6	0.200	215.2	0.0999*	15.5	0.255		
32.4	0.185	217.5	0.100	16.6	0.257		
38.3	0.173	219.2	0.100	17.6	0.255		
45.2	0.158	220.9	0.100	18.2	0.253		
48.0	0.150	222.7	0.100	19.0	0.250		
54.2	0.141	223.1	0.100*	24.5	0.20		
56.0	0.137	224.4	0.100	30.0	0.119		
59.3	0.133	225.1	0.101	32.5	0.10		
63.1	0.130	226.1	0.100	36.0	0.0825		
67.3	0.125	228.6	0.101	44.0	0.0575		
71.2	0.122	230.3	0.102	54.0	0.0425		

* Not shown on plot

FIGURE AND TABLE NO. 57R RECOMMENDED THERMAL CONDUCTIVITY OF TERBIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
2	0.0290	1.68	-456.1
3	0.0431	2.49	-454.3
4	0.0572	3.31	-452.5
5	0.0712	4.11	-450.7
6	0.0852	4.92	-448.9
7	0.0988	5.71	-447.1
8	0.113	6.53	-445.3
9	0.126	7.28	-443.5
10	0.138	7.97	-441.7
11	0.149	8.61	-439.9
12	0.159	9.19	-438.1
13	0.168	9.71	-436.3
14	0.177	10.2	-434.5
15	0.183	10.6	-432.7
16	0.189	10.9	-430.9
18	0.198	11.4	-427.3
20	0.203	11.7	-423.7
25	0.203	11.7	-414.7
30	0.193	11.2	-405.7
35	0.180	10.4	-396.7
40	0.168	9.71	-387.7
45	0.157	9.07	-378.7
50	0.147	8.49	-369.7
60	0.133	7.68	-351.7
70	0.124	7.16	-333.7
80	0.117	6.76	-315.7
90	0.113	6.53	-297.7
100	0.110	6.36	-279.7
150	0.102	5.89	-189.7
200	0.0998	5.77	- 99.7
250	0.102	5.89	- 9.7
273.2	0.103	5.95	32.0
300	0.104	6.01	80.3

REMARKS

The recommended values are for well-annealed 99.84% pure terbium with residual electrical resistivity ρ_0 = 4.85 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

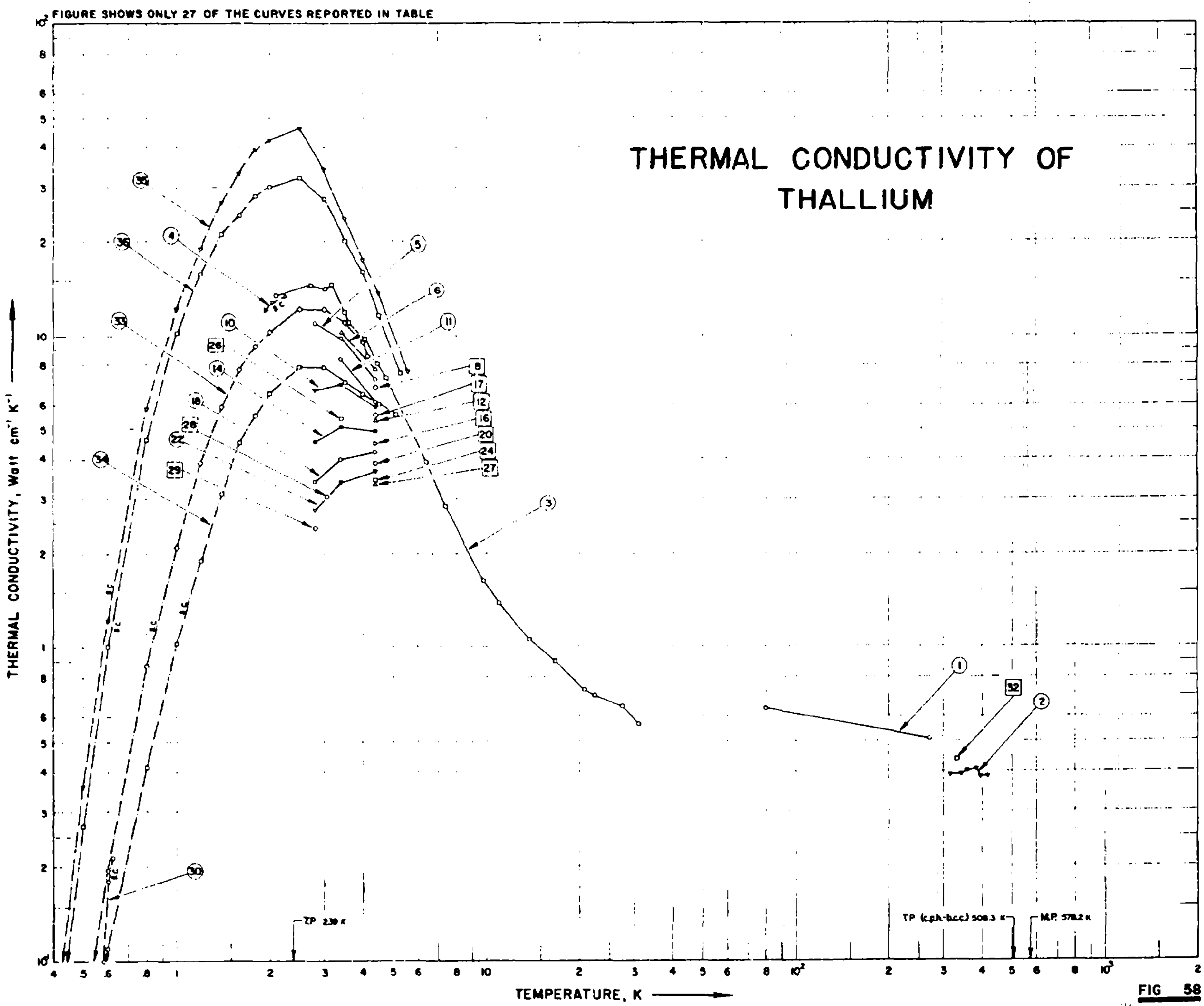


FIGURE SHOWS ONLY 27 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF THALLIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
TP 230 K
TP (c.p.h.-b.c.c.) 508.3 K
M.P. 576.2 K

FIG 58

SPECIFICATION TABLE NO. 58 THERMAL CONDUCTIVITY OF THALLIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 58]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	34	L	1927	80, 273			Pure thallium (electrolytic); electrical conductivity reported as 27.8 and 6.73 x 10^4 $ohm^{-1} cm^{-1}$ at 80 and 273 K respectively.
2	19	L	1923	318-422			Cylindrical specimen 1.5 cm in dia and 12 cm long; melting point 302 C.
3	122	L	1955	2.1-31		JM 2544; Tl1	99.99 pure; polycrystalline; 2.99 cm long and 0.16 cm in dia; supplied by Johnson Mathey and Co.; annealed in vacuo for several hrs and coated with celluloid varnish to prevent oxidation; measured in a magnetic field; in normal state.
4	122	L	1955	2.0-2.3		JM 2544; Tl1	The above specimen in superconducting state.
5	342	L	1953	2.8-4.4		JM 2544; Tl1	99.99 pure; polycrystalline; 5 cm long and ~0.2 cm in dia; supplied by Johnson Matthey and Co.; measured in a transverse magnetic field of 0.34 kOe.
6	342	L	1953	3.4, 4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 0.34 kOe.
7	342	L	1953	4.4		Tl 1	The above specimen measured in a transverse magnetic field of 0.51 kOe.
8	342	L	1953	4.4		Tl 1	The above specimen measured in a transverse magnetic field of 0.71 kOe.
9	342	L	1953	4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 0.71 kOe.
10	342	L	1953	2.8-4.4		Tl 1	The above specimen measured in a transverse magnetic field of 1.09 kOe.
11	342	L	1953	3.4, 4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 1.09 kOe.
12	342	L	1953	4.4		Tl 1	The above specimen measured in a transverse magnetic field of 1.42 kOe.
13	342	L	1953	4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 1.42 kOe.
14	342	L	1953	2.8-4.4		Tl 1	The above specimen measured in a transverse magnetic field of 1.79 kOe.
15	342	L	1953	3.4, 4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 1.79 kOe.
16	342	L	1953	4.4		Tl 1	The above specimen measured in a transverse magnetic field of 2.14 kOe.
17	342	L	1953	4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 2.14 kOe.
18	342	L	1953	2.8-4.4		Tl 1	The above specimen measured in a transverse magnetic field of 2.5 kOe.
19	342	L	1953	3.4, 4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 2.5 kOe.
20	342	L	1953	4.4		Tl 1	The above specimen measured in a transverse magnetic field of 2.85 kOe.
21	342	L	1953	4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 2.85 kOe.
22	342	L	1953	2.8-4.4		Tl 1	The above specimen measured in a transverse magnetic field of 3.22 kOe.
23	342	L	1953	3.4, 4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 3.22 kOe.
24	342	L	1953	4.4		Tl 1	The above specimen measured in a transverse magnetic field of 3.59 kOe.
25	342	L	1953	4.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 3.59 kOe.
26	342	L	1953	3.4		Tl 1	The above specimen measured in a longitudinal magnetic field of 3.70 kOe
27	342	L	1953	4.4		Tl 1	The above specimen measured in a transverse magnetic field of 3.79 kOe.

SPECIFICATION TABLE NO. 58 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
28	342	L	1953	3.4		Tl 1	The above specimen measured in a transverse magnetic field of 3.82 kOe.
29	342	L	1953	2.8		Tl 1	The above specimen measured in a transverse magnetic field of 3.91 kOe.
30	400	L	1953	0.29-0.63		Tl 1	The above specimen measured at low temperatures; in superconducting state; preliminary results reported.
31	412	L	1955	0.26-0.84	±5	Tl 1	More complete results from the same thallium batch (JM 2544) as the above specimen; in superconducting state.
32	230	L	1925	333			Specimen 1.9 cm in dia, 10 cm long; made from pure thallium from Eimer and Amend; electrical conductivity 5.88×10^4 ohm^{-1} cm^{-1} at 25 C.
33	712	L	1961	0.41-4.2		Tl-3	Pure; specimen 1 mm in dia; made from single crystal; specimen axis at 20 degrees with the crystal hexagonal axis; residual electrical resistivity 0.0026 μohm cm.
34	712	L	1961	0.19-5.2		Tl-4	Pure; specimen 1.1 mm in dia; made from single crystal; specimen axis at 80 degrees with the crystal hexagonal axis; residual electrical resistivity 0.0050 μohm cm.
35	712	L	1961	0.21-5.6		Tl-7	Pure; specimen 1.6 mm in dia; specimen axis at 30 degrees with the crystal hexagonal axis; residual electrical resistivity 0.00024 ± 0.00003 μohm cm.
36	712	L	1961	0.34-5.3		Tl-8	0.9 mm in dia; obtained by etching the above specimen; residual electrical resistivity 0.00045 μohm cm.

DATA TABLE NO. 58 THERMAL CONDUCTIVITY OF THALLIUM

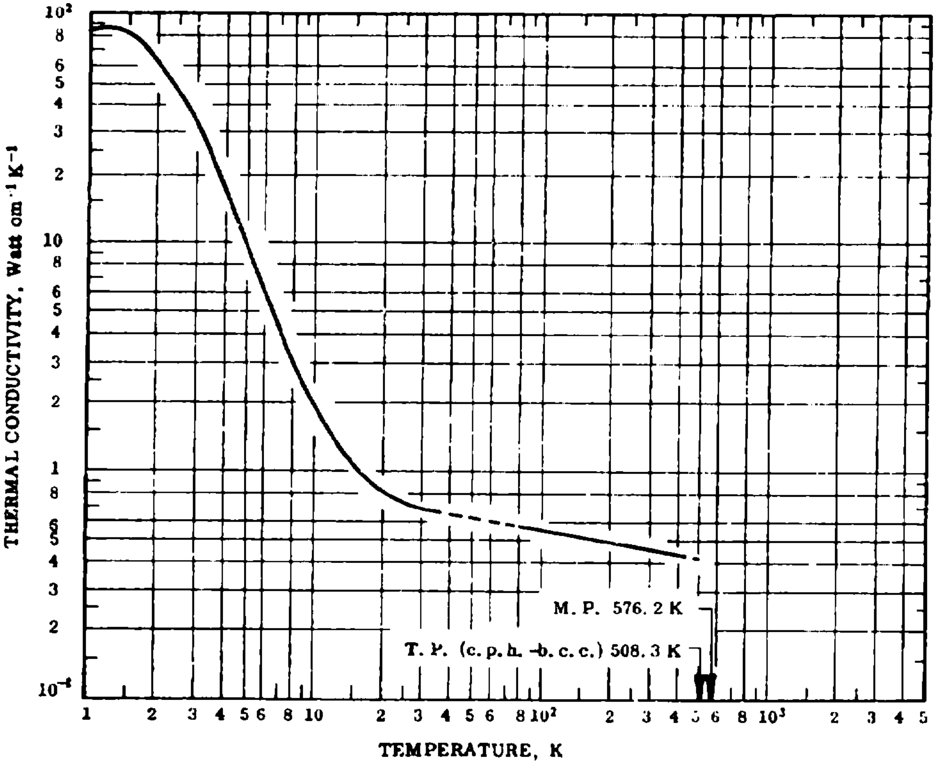
(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K, Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
80.0	0.635
273.0	0.506
CURVE 2	
318.2	0.391
345.2	0.392
361.2	0.400
363.2	0.401*
386.2	0.408
398.2	0.385
422.2	0.388
CURVE 3	
2.13	13.3
2.73	14.4
3.04	13.9
3.18	14.4
3.50	11.7
3.60	11.0
4.02	9.75
4.48	8.00
4.75	7.25
6.43	3.90
7.38	2.81
9.80	1.62
11.0	1.38
13.8	1.06
16.7	0.895
20.8	0.730
22.4	0.699
27.6	0.649
31.0	0.568
CURVE 4	
1.95	12.0
2.05	12.6
2.25	13.1
CURVE 5	
2.8	11.0
3.4	9.82
4.4	7.16
CURVE 6	
3.4	10.2
4.4	7.72
CURVE 7*	
4.4	7.03
CURVE 8	
4.4	6.79
CURVE 9*	
4.4	7.03
CURVE 10	
2.8	6.69
3.4	6.92
4.4	5.92
CURVE 11	
3.4	8.33
4.4	6.15
CURVE 12	
4.4	5.32
CURVE 13*	
4.4	6.25
CURVE 14	
2.8	4.55
3.4	5.09
4.4	4.92
CURVE 15*	
3.4	7.01
4.4	5.88
CURVE 16	
4.4	4.47
CURVE 17	
4.4	6.55
CURVE 18	
2.8	3.41
3.4	3.99
4.4	4.21
CURVE 19*	
3.4	6.15
4.4	5.32
CURVE 20	
4.4	3.88
CURVE 21*	
4.4	5.05
CURVE 22	
2.8	2.75
3.4	3.40
4.4	3.68
CURVE 23*	
3.4	5.58
4.4	4.86
CURVE 24	
4.4	3.45
CURVE 25*	
4.4	4.80
CURVE 26	
3.4	5.40
CURVE 27	
4.4	3.34
CURVE 28	
3.4	3.06
CURVE 29	
2.8	2.39
CURVE 30*	
0.290	0.0013
0.305	0.0014
0.323	0.00154
0.340	0.0017
0.363	0.00265
0.382	0.0033
0.390	0.0048
0.408	0.0063
0.466	0.010
0.484	0.0175
0.512	0.033
0.583	0.10
0.603	0.18
0.625	0.215
CURVE 31*	
0.255	0.00110
0.275	0.00135
0.330	0.00248
0.383	0.00378
0.402	0.00570
0.425	0.0075
0.465	0.0108
0.495	0.0127
0.507	0.0154
0.56	0.0202
0.59	0.0215
0.605	0.0205
0.645	0.0285
0.70	0.0320
0.74	0.0340
0.74	0.0495
0.84	0.0574
CURVE 32	
333.0	0.439
CURVE 33	
0.41	0.014
0.50	0.060
0.60	0.195
0.80	0.870
1.0	2.10
1.2	3.90
1.4	5.90
1.6	7.70
1.8	9.20
2.0	10.2
2.5	12.0
3.0	12.0
3.5	11.0
4.0	9.5
4.15	8.5
CURVE 34	
0.185	0.00034*
0.20	0.00046*
0.25	0.00102
0.30	0.00195
0.35	0.00430
0.40	0.0095
0.50	0.042
0.60	0.110
0.80	0.415
1.0	1.02
1.2	1.90
1.4	3.10
1.6	4.5
1.8	5.5
2.0	6.5
2.5	7.8
3.0	7.8
3.5	7.0
4.0	6.5
4.5	6.0
5.16	5.4
CURVE 35	
0.205	0.00065*
0.25	0.0016
0.30	0.0036
0.325	0.0060
0.35	0.0145
0.40	0.056
0.50	0.360
0.60	1.22
0.80	5.8
1.0	12.0
1.2	19.0
1.4	26.5
1.6	33.0
1.8	39.0
2.0	42.0
2.5	46.0
3.0	34.0
3.5	23.5
4.0	17.5
CURVE 35(cont.)	
4.5	13.5
5.6	7.60
CURVE 36	
0.34	0.0080
0.40	0.044
0.50	0.270
0.60	1.00
0.80	4.60
1.0	10.2
1.2	15.7
1.4	21.0
1.6	24.0
1.8	28.0
2.0	30.0
2.5	32.0
3.0	27.5
3.5	20.0
4.0	16.0
4.5	11.5
5.3	7.50

*Not shown on plot

FIGURE AND TABLE NO. 58R RECOMMENDED THERMAL CONDUCTIVITY OF THALLIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1.0	82.7	4780	-457.9
1.2	86.0	4970	-457.5
1.5	81.9	4730	-456.9
1.8	71.2	4110	-456.5
2.0	63.4	3660	-456.1
2.5	45.9	2650	-455.2
3.0	33.2	1920	-454.3
3.5	23.8	1380	-453.4
4.0	17.6	1020	-452.5
5	10.2	589	-450.7
6	6.19	358	-448.9
7	4.04	233	-447.1
8	2.95	170	-445.3
9	2.30	133	-443.5
10	1.87	108	-441.7
15	1.07	61.8	-432.7
20	0.811	46.9	-423.7
30	0.682	39.4	-405.7
40	(0.650)‡	(37.6)	-387.7
50	(0.626)	(36.2)	-369.7
60	(0.607)	(35.1)	-351.7
70	(0.590)	(34.1)	-333.7
80	0.578	33.4	-315.7
90	0.567	32.8	-297.7
100	0.556	32.1	-279.7
150	0.519	30.0	-189.7
200	0.494	28.5	- 99.7
250	0.476	27.5	- 9.7
273.2	0.469	27.1	32.0
300	0.461	26.6	80.3
400	0.438	25.3	260.3
500	(0.421)	(24.3)	440.3

REMARKS

The recommended values are for well-annealed high-purity thallium with residual electrical resistivity $\rho_0 = 0.000289\ \mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 60 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.25, $\alpha' = 2.27_5 \times 10^{-3}$, and $\beta = 0.00982$. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

*T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡Values in parentheses are extrapolated or interpolated.

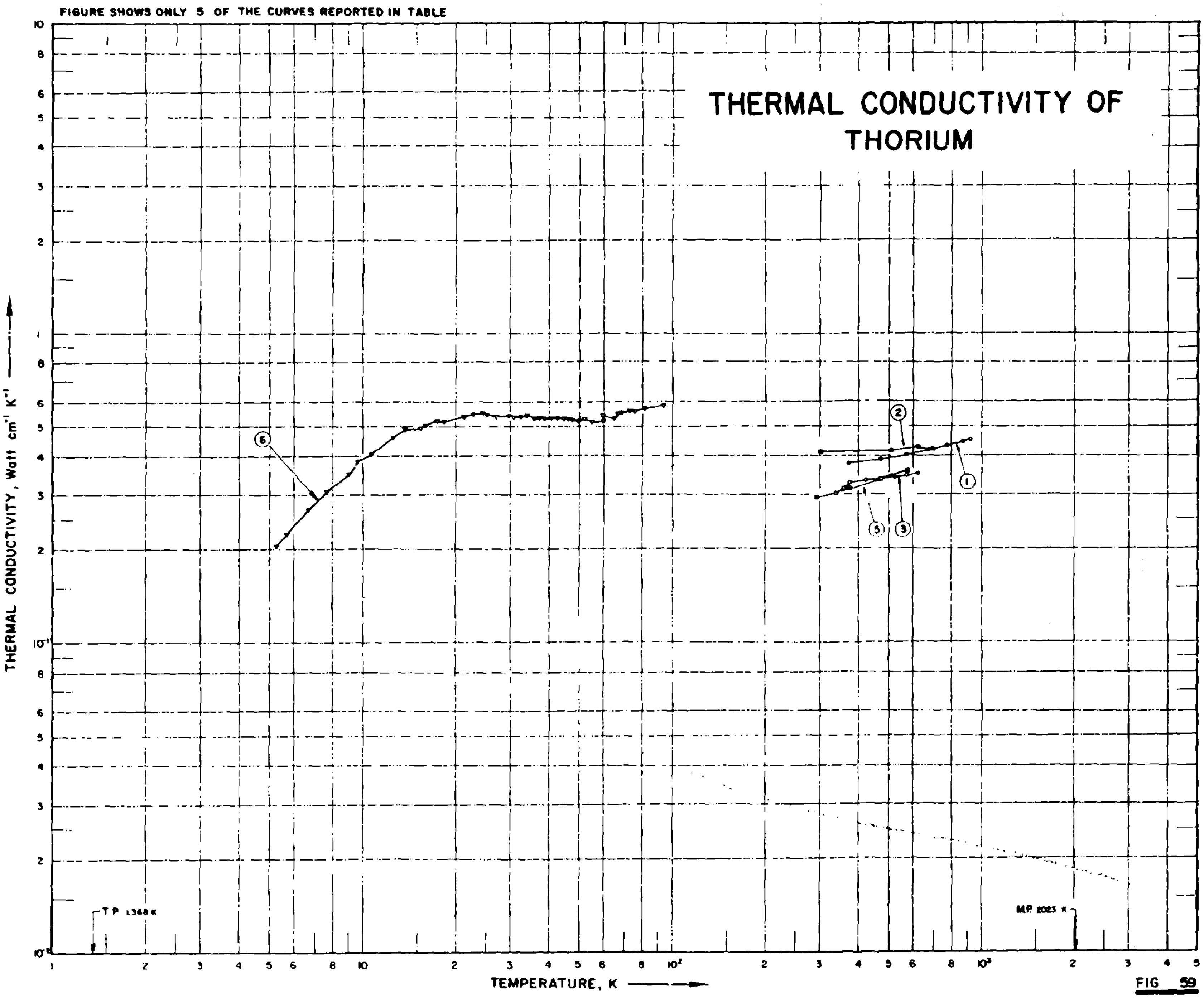


FIGURE SHOWS ONLY 5 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF THORIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P. 1368 K
M.P. 2023 K
1
2
3
5
6

FIG 59

SPECIFICATION TABLE NO. 59 THERMAL CONDUCTIVITY OF THORIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 59]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	94, 266		1951	373-923		Ames thorium	Specimen hot rolled at 733 C and air cooled; density 11.6 g cm^{-3}; melting point 1680 ± 25 C; data determined in an atmosphere of purified argon.
2	130, 778	P	1951	301-697			99.85 pure; specimen 0.125 in. in dia, ~ 50 cm long; thermal conductivity values calculated from measured data of thermal diffusivity using density 11.558 g cm^{-3}, and specific heat of 0.1188 joules $g^{-1}C^{-1}$ (from C.F. Miller).
3	422, 239		1945	338-623			Specimen made from Ames extruded thorium.
4	235, 239	L	1944	335-367			Pure; specimen 1.618 cm long, cross sectional area 5.042 cm^2.
5	423		1945	293-573			Specimen ~6 cm long, 1 cm in dia; manufactured by Westinghouse Lamp Co.; x-ray analysis after test showed the presence of thorium oxide (probably formed during the test); electrical resistivity reported as 27.5 and 32 μ ohm cm at 20 and 100 C, respectively; Lorenz function 2.76 and 2.68 x 10^{-8} V^2K^{-2} at 20 and 100 C, respectively.
6	935	L	1965	5.3-94	5		Cylindrical specimen 4 mm in dia and 30 mm long; supplied by Dr. J.A. Lee, A.E.R.E. Harwell; machined from an ingot or argon-arc-melted van Arkel metal of high purity; electrical resistivity ratio $\rho(273\ K)/\rho(4.2\ K)$ = 20.49; electrical resistivity reported as 0.75, 0.91, 1.26, 1.82, 2.39, 2.97, 4.06, 5.15, 14.7, and 15.9 μ ohm cm at 10, 20, 30, 40, 50, 60, 80, 100, 273.15, and 295 K, respectively; residual electrical resistivity 0.72 μ ohm cm; Lorenz function reported as 2.85, 2.67, 2.45, 2.28, 2.24, 2.49, 2.82, and 3.02 x 10^{-8} V^2K^{-2} at 5, 15, 18, 25, 30, 50, 75, and 100 K, respectively; thermal conductivity data averaged from the results of several separate runs.

DATA TABLE NO. 59 THERMAL CONDUCTIVITY OF THORIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
373.2	0.377
473.2	0.389
573.2	0.402
673.2	0.418
773.2	0.431
873.2	0.444
923.2	0.452

CURVE 2

T	k
301.2	0.412
510.7	0.416
623.7	0.428
697.0	0.420

CURVE 3

T	k
338.2	0.301
356.7	0.314
373.2	0.326
423.2	0.331
473.2	0.336
523.2	0.340
573.2	0.345
623.2	0.350

CURVE 4

T	k
334.5	0.307
344.0	0.313
345.3	0.309
351.0	0.311
352.7	0.313
358.2	0.318
366.5	0.318

CURVE 5

T	k
293.2	0.293
373.2	0.314
473.2	0.335
573.2	0.356

CURVE 6

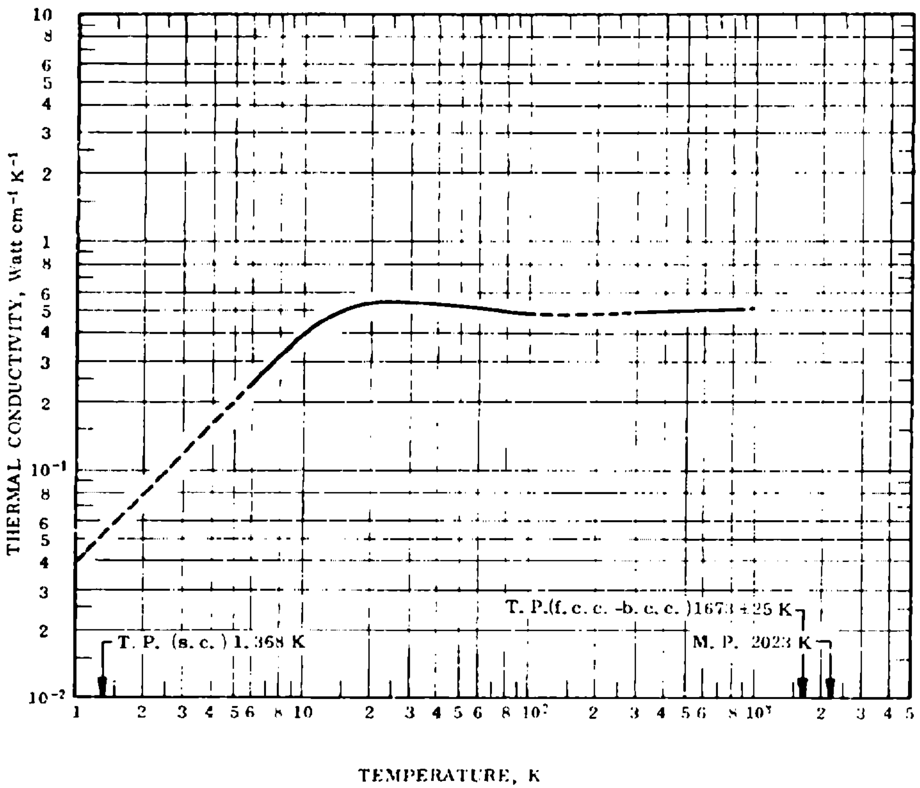
T	k
5.3	0.205
5.7	0.223
6.7	0.268
7.7	0.308
9.1	0.349
9.7	0.382
10.7	0.405
12.6	0.459
13.8	0.488
13.9	0.491*
15.5	0.493
16.1	0.502
17.5	0.523
18.4	0.518
18.4	0.530*
21.3	0.538
21.3	0.542*
22.8	0.548
24.5	0.551
25.2	0.545
27.0	0.539
29.7	0.542
30.9	0.535
32.5	0.538
34.0	0.542
35.9	0.528
37.4	0.532
38.7	0.531
40.8	0.531
42.6	0.531
44.6	0.529
46.0	0.529
47.5	0.524
50.0	0.522
50.0	0.517*
52.3	0.529
56.2	0.517
59.9	0.519
59.9	0.543
65.2	0.531
66.7	0.547
69.0	0.553

CURVE 6 (cont.)

T	k
73.1	0.562
76.0	0.564
81.8	0.570
82.6	0.571*
94.0	0.584

*Not shown on plot

FIGURE AND TABLE NO. 59R RECOMMENDED THERMAL CONDUCTIVITY OF THORIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.498	28.8	440.3
1	(0.0394)‡	(2.28)	-457.9	600	0.501	28.9	620.3
2	(0.0785)	(4.54)	-456.1	700	0.504	29.1	800.3
3	(0.118)	(6.82)	-454.3	800	0.508	29.4	980.3
4	(0.158)	(9.13)	-452.5	900	0.511	29.5	1160
5	(0.197)	(11.4)	-450.7	1000	(0.515)	(29.8)	1340
6	0.237	13.7	-448.9				
7	0.276	15.9	-447.1				
8	0.314	18.1	-445.3				
9	0.352	20.3	-443.5				
10	0.387	22.4	-441.7				
11	0.419	24.2	-439.9				
12	0.447	25.8	-438.1				
13	0.470	27.2	-436.3				
14	0.488	28.2	-434.5				
15	0.499	28.8	-432.7				
16	0.511	29.5	-430.9				
18	0.526	30.4	-427.3				
20	0.538	31.1	-423.7				
25	0.548	31.7	-414.7				
30	0.547	31.6	-405.7				
35	0.542	31.3	-396.7				
40	0.537	31.0	-387.7				
45	0.532	30.7	-378.7				
50	0.527	30.5	-369.7				
60	0.515	29.8	-351.7				
70	0.504	29.1	-333.7				
80	0.497	28.7	-315.7				
90	0.492	28.4	-297.7				
100	(0.488)	(28.2)	-279.7				
150	(0.486)	(28.1)	-189.7				
200	(0.488)	(28.2)	- 99.7				
250	(0.489)	(28.3)	- 9.7				
273.2	(0.490)	(28.3)	32.0				
300	0.491	28.4	80.3				
350	0.493	28.5	170.3				
400	0.495	28.6	260.3				

REMARKS

The recommended values are for well-annealed high-purity thorium with residual electrical resistivity $\rho_0 = 0.72\ \mu\Omega$ cm (characterization by ρ_0 becomes important below room temperature). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 10 to 15% of the true values.

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* T_1 in K, k_1 in Watt $cm^{-1} K^{-1}$, T_2 in F, and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$.

‡ Values in parentheses are extrapolated or estimated.

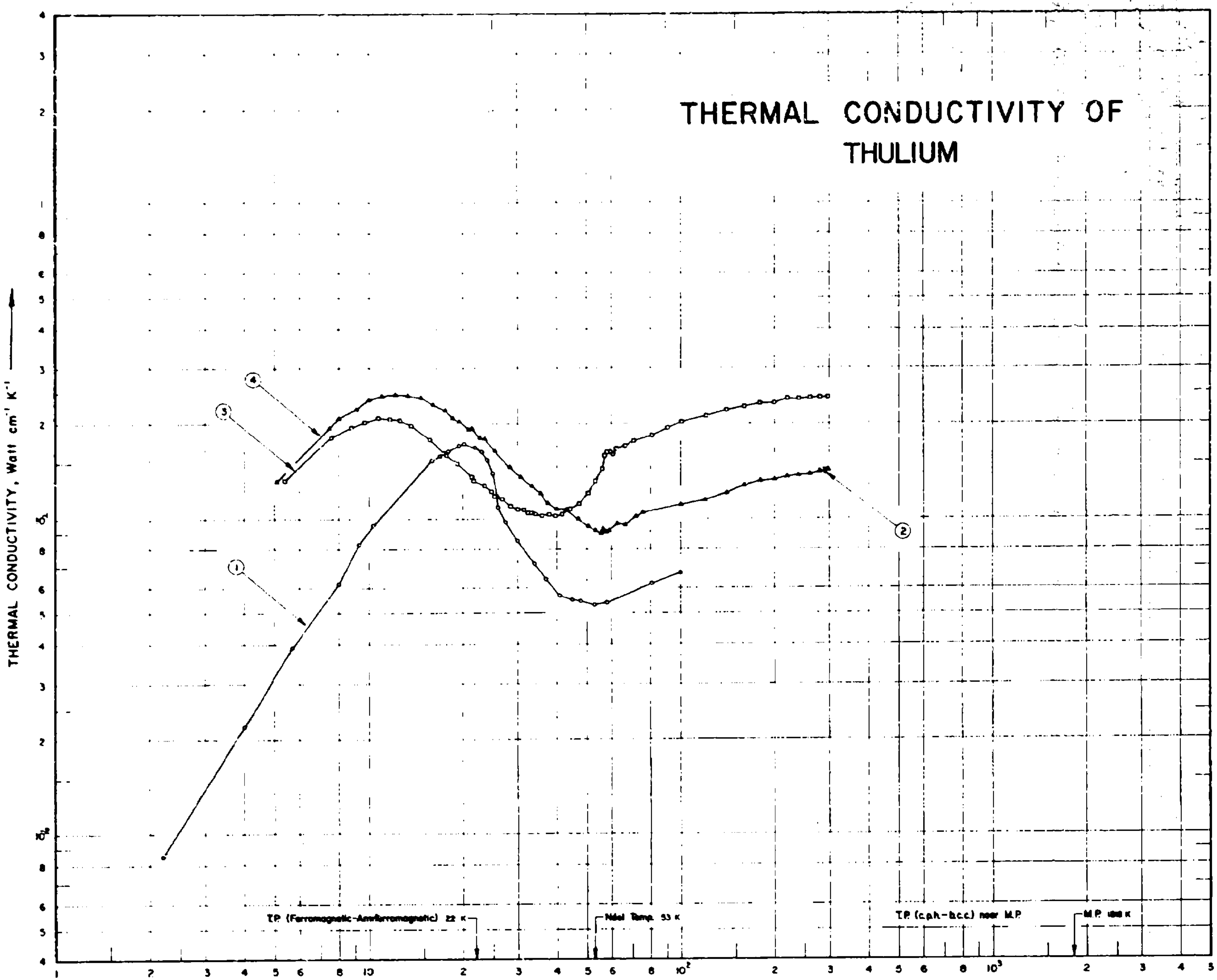

THERMAL CONDUCTIVITY OF THULIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P. (Ferromagnetic-Antiferromagnetic) 22 K
Néel Temp. 53 K
T.P. (c.p.h.-b.c.c.) near M.P.
M.P. 1818 K
1
2
3
4

FIG 60

SPECIFICATION TABLE NO. 60 THERMAL CONDUCTIVITY OF THULIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 60]

Curve No.	Ref. No.	Method Used*	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	994	L	1965	2.2-100			99.99 pure; polycrystalline; strip specimen 0.25 mm thick; annealed in a stream of helium vapor at 650 C for 3 hrs; electrical resistivity reported as 12.7 and 79 µohm cm at 4.2 and 293 K, respectively; antiferromagnetic-paramagnetic transition at 53 K; Lorenz function reported as 7.30 x 10^{-8} V^2 K^{-2} in the residual resistance region.
2	256	C	1966	291	± 4		< 0.1 rare earth metal and ~0.01 base metals; polycrystalline; 1.2 x 1.2 x 0.31 cm; electrical resistivity 72 µohm cm at 291 K; measurements made using 2 different thermal comparators.
3	‡	L	1967	5.1-298	6-8		< 0.0200 Ho, < 0.0200 Lu, < 0.0200 Y, 0.0061 O, < 0.0060 Al, < 0.0060 Si, < 0.0050 Fe, < 0.0050 Ni, < 0.0030 Er, < 0.0020 Ca, < 0.0020 Cr, < 0.0010 Mg, < 0.0010 Yb, 0.0001 H, trace of Mn, and faint trace of Dy; single crystal; 7.23 x 1.250 x 1.224 mm; arc-melted ingot suspended and sealed in helium at 0.5 atm in a tantalum bomb, placed in an annealing furnace consisting of a temperature gradient region (25 C cm^{-1}) and a constant temperature region, annealed at 1200 C for 12 hrs and at 1300 C for 12 hrs in the gradient region, then annealed at 1425 C for 16 hrs in the constant temperature region, cut and hand-lapped to size; electrical resistivity reported as 1.730, 1.750, 1.733, 1.746, 1.798, 2.461, 3.633, 5.522, 7.703, 10.35, 15.98, 21.87, 29.07, 31.11, 32.76, 36.23, 39.72, 49.44, 63.25, 76.20, and 88.12 µohm cm at 2.7, 4.2, 6.0, 8.0, 10.0, 16.0, 20.2, 24.5, 28.3, 32.1, 39.3, 46.3, 54.0, 56.5, 60.3, 70.9, 82.7, 120.3, 180.7, 241.6, and 298.9 K, respectively; electrical resistivity ratio $\rho_{300K}/\rho_{4.2K}$ = 51.0; residual electrical resistivity 1.73 µohm cm; Lorenz function reported as 4.08, 4.38, 3.45, 3.70, 4.22, 4.66, 4.88, 5.14, 5.20, 5.12, 4.78, 4.49, 4.26, and 4.17 x 10^{-8} V^2 K^{-2} at 5.1, 9.1, 17.4, 22.6, 31.1, 43.3, 55.2, 59.2, 63.8, 78.4, 135.0, 200.5, 262.2, and 300.0 K, respectively; heat flow along b-axis.
4	‡	L	1967	5.4-299			< 0.0200 Ho, < 0.0200 Lu, < 0.0200 Y, 0.0100 O, < 0.0060 Al, < 0.0060 Si, < 0.0050 Fe, < 0.0050 Ni, < 0.0030 Er, < 0.0020 Ca, < 0.0020 Cr, < 0.0010 Mg, < 0.0010 Yb, 0.0001 H, 0.0003 N, traces of Cu and Dy, and faint traces of Mn and W; single crystal; 7.24 x 1.450 x 1.160 mm; same fabrication method as above; electrical resistivity reported as 3.641, 3.647, 3.708, 4.161, 5.558, 8.218, 13.94, 19.37, 23.02, 25.81, 25.85, 25.72, 24.35, 21.24, 19.90, 18.60, 17.80, 17.31, 18.21, 19.66, 20.51, 25.33, 33.93, and 47.05 µohm cm at 1.4, 4.2, 8.0, 12.0, 16.0, 20.0, 26.0, 31.1, 37.6, 44.1, 45.4, 47.1, 51.2, 54.9, 56.0, 56.8, 57.5, 57.9, 61.9, 73.6, 90.1, 120.8, 195.0, and 300.7 K, respectively; electrical resistivity ratio $\rho_{300K}/\rho_{4.2K}$ = 12.9; residual electrical resistivity 3.65 µohm cm; Lorenz function reported as 8.87, 8.98, 7.44, 5.98, 5.86, 6.04, 6.75, 6.20, 5.66, 4.81, 4.96, 4.83, 4.68, 4.21, 3.99, and 3.77 x 10^{-8} V^2 K^{-2} at 4.5, 6.4, 10.7, 15.6, 18.0, 21.8, 31.8, 44.9, 52.3, 56.6, 59.7, 67.4, 86.7, 160.6, 220.2, and 300.1 K, respectively; heat flow along c-axis.

‡ Edwards, D. W. and Legvold, S., "Transport Properties of Thulium Single Crystal," to be published in Physical Review; also USAEC IS-T-173, 1967.

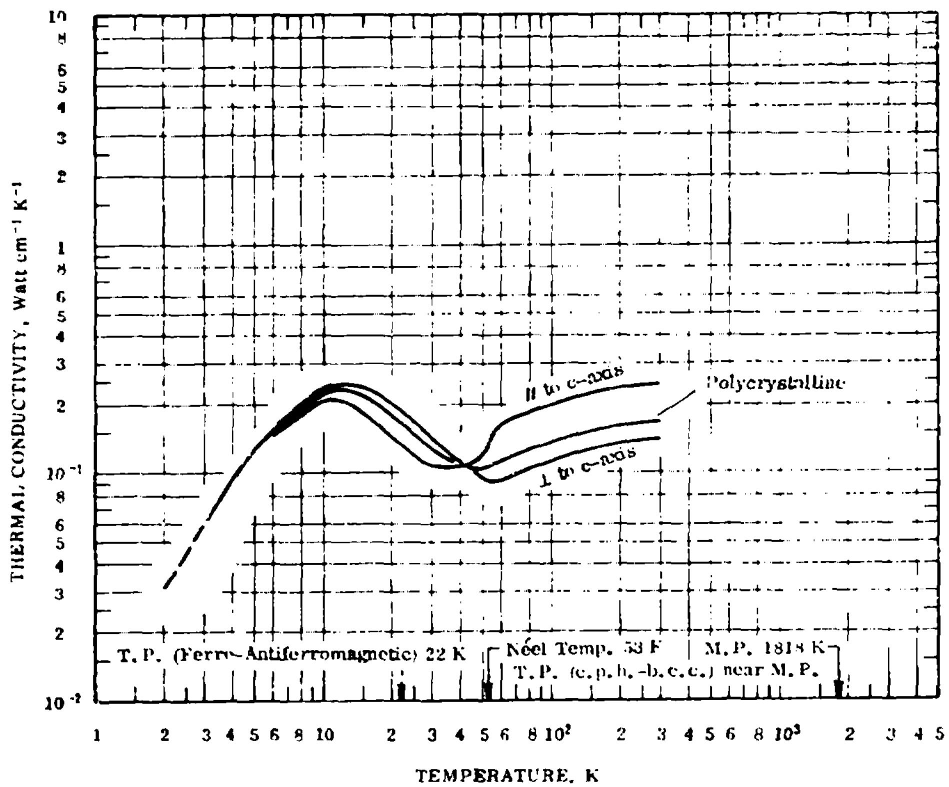
DATA TABLE NO. 60 THERMAL CONDUCTIVITY OF THULIUM

(Impurity <0.20% each; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k	T	k	T	k
CURVE 1		CURVE 3 (cont.)		CURVE 4		CURVE 4 (cont.)	
2.2	0.0085	10.0	0.238	5.4	0.132	121.0	0.211
4.0	0.022	11.1	0.245	7.6	0.181	140.7	0.220
5.7	0.039	12.2	0.247	8.8	0.195	160.6	0.226
8.0	0.062	13.4	0.246	9.7	0.203	180.9	0.231
9.3	0.083	14.7	0.242	10.7	0.209	201.0	0.232
10.3	0.096	16.1	0.239	11.7	0.207	221.1	0.239
16.0	0.153	17.6	0.221	12.6	0.206	240.9	0.239
17.0	0.158	18.6	0.209	13.7	0.197	261.0	0.240
17.5	0.162	19.6	0.204	15.7	0.179	280.8	0.241
18.0	0.164	20.9	0.192	17.8	0.159	298.6	0.241
19.5	0.170	21.5	0.194	19.4	0.149		
20.3	0.172	22.7	0.181	21.5	0.136		
22.0	0.168	23.6	0.180	21.7	0.132		
23.0	0.163	25.5	0.165	23.6	0.128		
24.0	0.154	28.4	0.146	24.7	0.123		
24.5	0.147	30.7	0.136	25.5	0.118		
25.0	0.139	33.4	0.127	26.8	0.116		
25.8	0.118	35.7	0.121	28.5	0.110		
26.0	0.109	37.5	0.113	30.0	0.107		
27.5	0.098	40.1	0.108	31.4	0.107		
30.0	0.085	43.3	0.108	32.4	0.105		
34.0	0.072	47.1	0.100	33.2	0.105		
37.0	0.064	50.6	0.095	34.2	0.104		
41.0	0.057	53.5	0.092	36.1	0.103		
45.0	0.055	55.8	0.090	37.9	0.104		
48.0	0.0545	56.5	0.092	39.7	0.103		
53.3	0.0530	57.8	0.091	41.7	0.104		
58.3	0.0540	59.2	0.092	44.4	0.107		
81.0	0.0620	62.8	0.097	47.3	0.112		
100.0	0.0670	66.8	0.096	50.7	0.121		
		71.8	0.102	53.6	0.132		
CURVE 2		75.7	0.105	56.1	0.144		
		101.2	0.111	57.4	0.158		
291	0.140	120.9	0.115	58.5	0.163		
291	0.141	141.1	0.121	59.6	0.163		
		161.1	0.128	61.0	0.160		
CURVE 3		181.1	0.132	62.4	0.166		
		200.9	0.133	66.6	0.170		
5.1	0.133	220.8	0.136	70.5	0.176		
7.5	0.195	240.9	0.137	80.5	0.184		
8.0	0.209	260.8	0.138	90.7	0.194		
9.1	0.223	280.8	0.141	100.7	0.202		
		298.5	0.143				

FIGURE AND TABLE NO. 60R RECOMMENDED THERMAL CONDUCTIVITY OF THULIUM



RECOMMENDED VALUES*

	Single Crystal				Polycrystalline		
	(// to c-axis)		(⊥ to c-axis)				
T_1	k_1	k_2	k_1	k_2	k_1	k_2	T_2
0	0	0	0	0	0	0	-459.7
2					(0.0308)‡	(1.78)	-456.1
3					0.0592	3.42	-454.3
4					0.0928	5.55	-452.5
5					0.127	7.34	-450.7
6	0.147	8.49	0.159	9.19	0.155	8.96	-448.9
7	0.169	9.76	0.184	10.6	0.178	10.3	-447.1
8	0.186	10.7	0.205	11.8	0.198	11.4	-445.3
9	0.198	11.4	0.223	12.9	0.214	12.4	-443.5
10	0.206	11.9	0.236	13.6	0.226	13.0	-441.7
11	0.209	12.1	0.244	14.1	0.230	13.3	-439.9
12	0.208	12.0	0.246	14.2	0.232	13.4	-438.1
13	0.203	11.7	0.245	14.2	0.230	13.3	-436.3
14	0.194	11.2	0.243	14.0	0.226	13.1	-434.5
15	0.185	10.7	0.238	13.8	0.219	12.7	-432.7
16	0.175	10.1	0.232	13.4	0.211	12.2	-430.9
18	0.158	9.13	0.218	12.6	0.194	11.2	-427.3
20	0.144	8.32	0.202	11.7	0.179	10.3	-423.7
25	0.120	6.95	0.167	9.65	0.149	8.61	-414.7
30	0.106	6.12	0.141	8.15	0.127	7.34	-405.7
35	0.105	6.07	0.123	7.11	0.116	6.70	-396.7
40	0.105	6.07	0.110	6.36	0.108	6.24	-387.7
42.4	0.106	6.12	0.106	6.12	0.106	6.12	-383.4
45	0.109	6.30	0.102	5.89	0.104	6.01	-378.7
50	0.119	6.88	0.0948	5.48	0.103	5.95	-369.7
55	0.141	8.15	0.0912	5.27	0.107	6.18	-360.7
58	0.160	9.24	0.0911	5.26	0.111	6.41	-355.3
60	0.164	9.48	0.0920	5.32	0.113	6.53	-351.7
70	0.175	10.1	0.0977	5.65	0.120	6.93	-333.7
80	0.185	10.7	0.105	6.07	0.126	7.28	-315.7
90	0.193	11.2	0.108	6.24	0.131	7.57	-297.7
100	0.200	11.6	0.111	6.41	0.135	7.80	-279.7
150	0.224	12.9	0.126	7.28	0.152	8.78	-189.7
200	0.235	13.6	0.134	7.74	0.162	9.35	-99.7
250	0.241	13.9	0.138	7.97	0.167	9.65	-9.7
273.2	0.242	14.0	0.140	8.09	0.168	9.71	32.0
300	0.242	14.0	0.141	8.15	0.169	9.71	80.3

REMARKS

The recommended values are for well-annealed 99.9⁺% pure thulium with residual electrical resistivity ρ_0 = 3.5 and 1.7 $\mu\Omega$ cm along the directions parallel and perpendicular to the c-axis of the single crystal, respectively (characterization by ρ_0 becomes important at temperatures below about 200 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature and 5 to 15% at other temperatures.

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* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

THERMAL CONDUCTIVITY OF TIN

Continued on Figure 61-2

FIGURE SHOWS ONLY 70 OF THE CURVES REPORTED IN TABLE

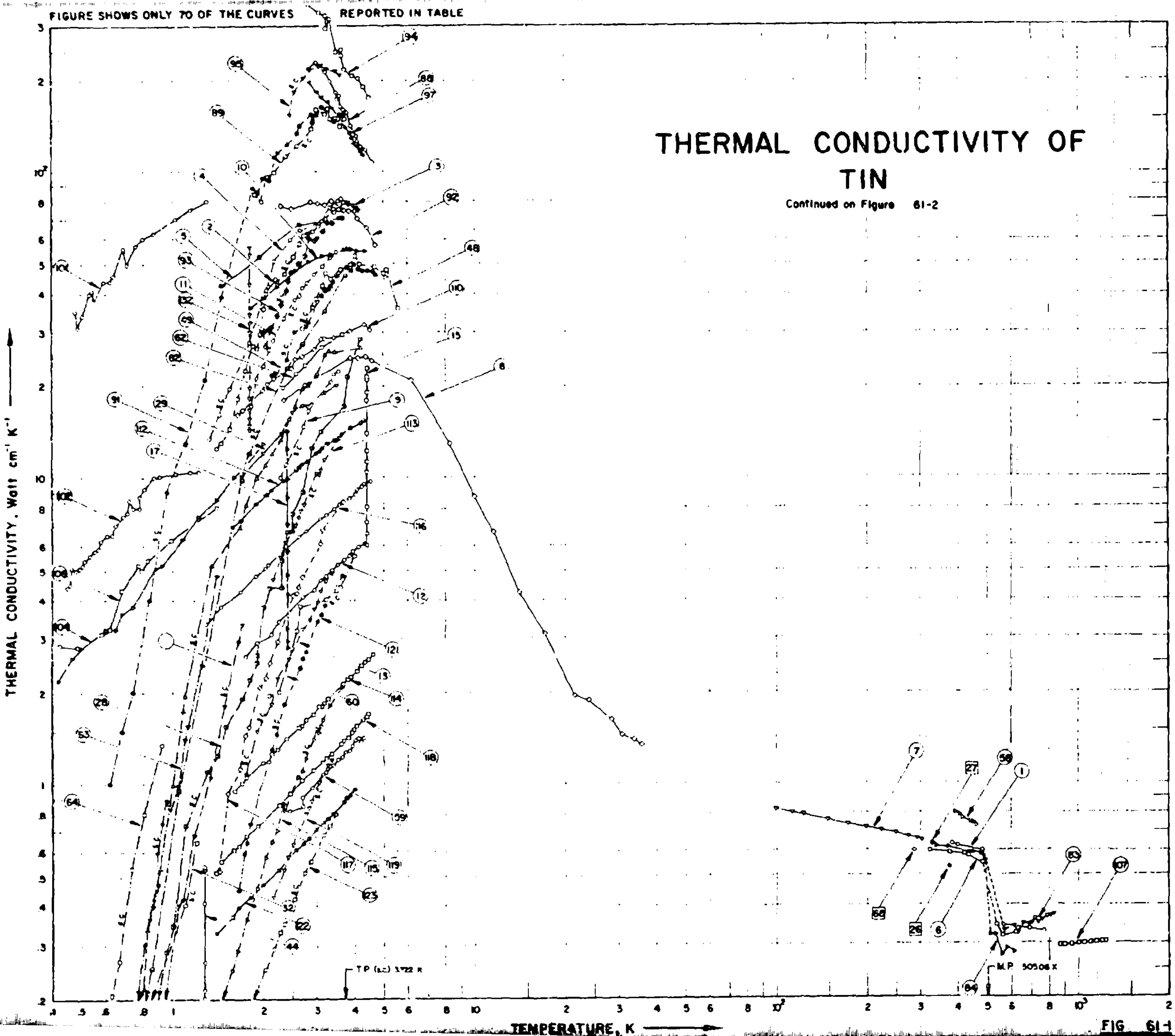


FIG 61-1

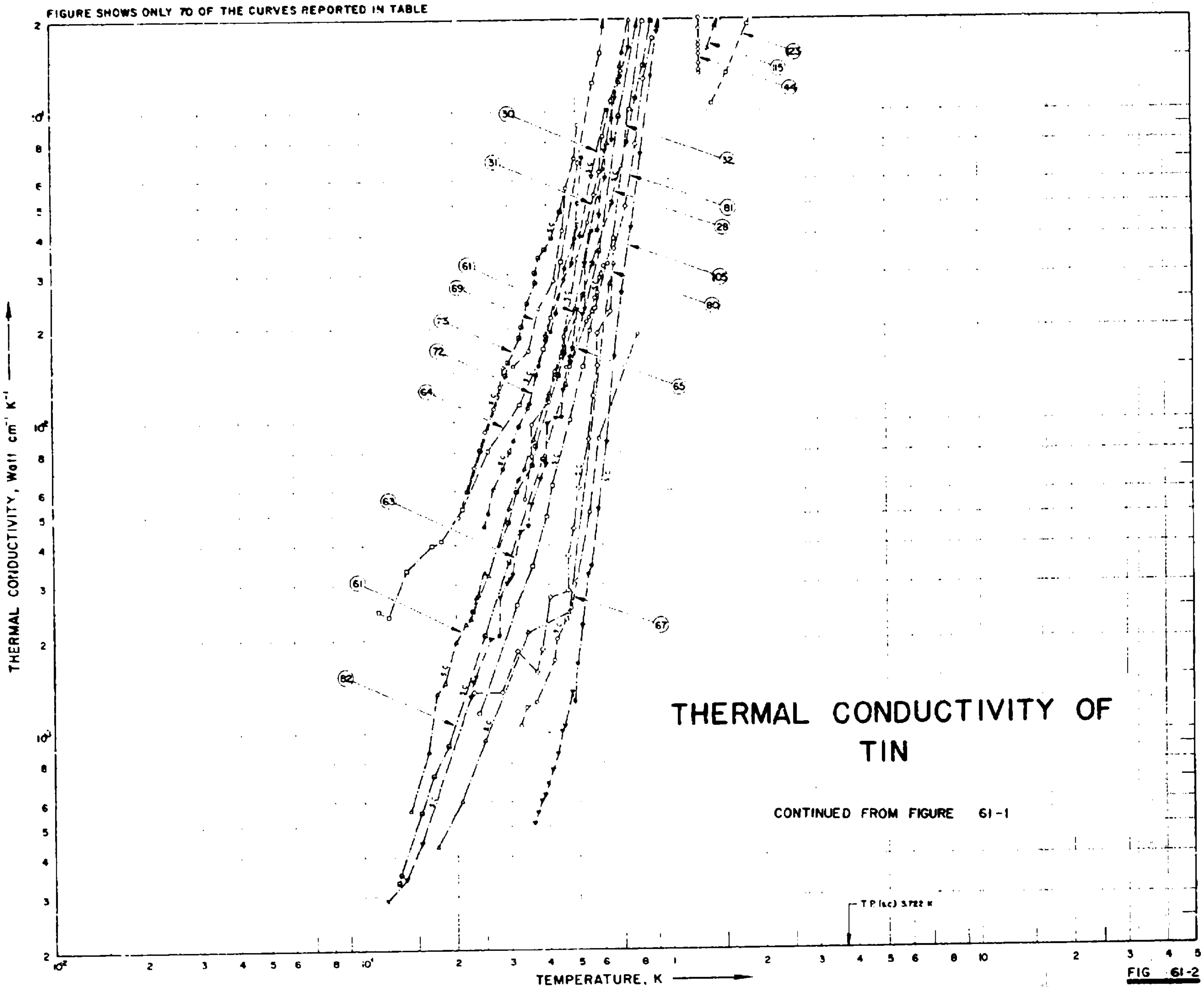


FIGURE SHOWS ONLY 70 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF TIN
CONTINUED FROM FIGURE 61-1
T.P. (sc) 3.722 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
123
115
44
30
32
31
81
28
105
80
61
69
73
72
65
64
63
61
67
82

FIG 61-2

SPECIFICATION TABLE NO. 61 THERMAL CONDUCTIVITY OF TIN

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 61]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	85	L	1919	381-771			Pure; in both solid and liquid states.
2	117	L	1949	1.4-3.7		Sn I	99.992⁺ pure; single crystal; 2.3 mm dia; made of Chempur tin (99.992 pure) purified further by several times melting in vacuo, crystalizing and etching; measured with heat flow at 85 degrees to the tetragonal axis; in superconducting state.
3	117	L	1949	3.8-4.1		Sn I	The above specimen in normal state.
4	117	L	1949	1.3-3.6		Sn II	Single crystal; 0.8 mm dia x 70 mm long; made of Chempur tin purified further by several times melting in vacuo, crystalizing and etching; electrical resistivity ratio $\rho(273K)/\rho(4.2K) = 16700$; measured with heat flow at 85 degrees to the tetragonal axis; in superconducting state.
5	117	L	1949	1.5-3.7		Sn II	The above specimen measured in a magnetic field of strength 510 Oe; in normal state.
6	19	L	1923	323-620			Specimen in both solid and liquid states; 12 cm long and 1.5 cm in dia; melting point 232 C.
7	98	L	1908	99-303			Pure; from Kahlbaum; density 7.28 g cm^{-3} at 21 C; electrical resistivity reported as 3.00 and 10.65 μohm cm at -170.4 and 11.6 C, respectively.
8	122	L	1955	2.3-3.6	3	Sn 1	99.997 pure; single crystal; 2.95 cm long, 0.389 cm in dia; supplied by Johnson, Matthey Co. Ltd.; measured in a magnetic field; in normal state.
9	122	L	1955	2.3-3.6	3	Sn 1	The above specimen in superconducting state.
10	457	L	1949	1.8-4.4	3	Sn 2	99.997 Sn (by difference), 0.003 impurities; polycrystalline; measured in a longitudinal magnetic field; in normal state.
11	457	L	1949	1.8-3.5	3	Sn 2	The above specimen in superconducting state.
12	457	L	1949	1.8-4.4	3	Sn 3	99.967 Sn (by difference), 0.033 Hg; polycrystalline; measured in a longitudinal magnetic field; in normal state.
13	457	L	1949	1.8-3.4	3	Sn 3	The above specimen in superconducting state.
14	270	P	1915	308.2			Specimen 25 cm long, 0.25 cm in dia; thermal conductivity value calculated from measured thermal diffusivity using the values of density and specific heat taken from the Tabellen of Landolt and Bornstein.
15	342	L	1953	4.4		Sn 1	99.997 pure; single crystal; supplied by Johnson, Matthey Co. Ltd.; measured in transverse magnetic fields with strength H ranging from 0.19 to 3.57 kOe.
16	342	L	1953	3.0		Sn 1	The above specimen measured in transverse magnetic fields with strength H ranging from 0.29 to 3.57 kOe.
17	342	L	1953	2.4		Sn 1	The above specimen measured in transverse magnetic fields with strength H ranging from 0.35 to 3.75 kOe.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
18	342	L	1953	2.4		Sn 1	The above specimen measured in longitudinal magnetic fields with strength H ranging from 0.29 to 3.75 kOe.
19	342	L	1953	3.0		Sn 1	The above specimen measured in longitudinal magnetic fields with strength H ranging from 0.35 to 3.66 kOe.
20	342	L	1953	4.4		Sn 1	The above specimen measured in longitudinal magnetic fields with strength H ranging from 0.35 to 3.75 kOe.
21	74	L	1950	2.21	3	Sn 2	99.996 pure; homogenous solid solution with few large crystals; superconducting transition point 3.71 K; measured in magnetic fields with strength H ranging from 62 to 1453 gauss.
22	74	L	1950	4.29	3	Sn 2	The above specimen measured in magnetic fields with strength H ranging from 62 to 1453 gauss.
23	74	L	1950	2.42	3	Sn 3	99.967 pure; homogeneous solid solution with few large crystals; superconducting transition point 3.68 K; measured in magnetic fields with strength H ranging from 123 to 1213 gauss.
24	412	L	1955	0.39-0.65			99.997 pure; single crystal; supplied by Johnson, Matthey Co. Ltd.; in superconducting state (same specimen as used for curve No. 8).
25	412	L	1955	0.25-0.80			99.997 pure; polycrystalline; supplied by Johnson, Matthey Co. Ltd.; in superconducting state.
26	460		1957	373.2			Electrical conductivity 6.6×10^4 $ohm^{-1} cm^{-1}$ at 100 C.
27	230	L	1925	327			0.03 total impurities; specimen 10 cm long and 1.9 cm in dia; electrical conductivity 8.96×10^4 $ohm^{-1} cm^{-1}$ at 22 C.
28	452	L	1955	0.2-4.2	2-4	JM 4600; Sn2	Spectroscopically pure; single crystal with tetragonal axis parallel to rod axis; 2.530 mm dia rod supplied by Johnson, Matthey Co. Ltd.; cast and recrystallized; superconducting state.
29	452	L	1955	1.7-3.5	2-4	JM 4600; Sn2	The above specimen measured in a longitudinal field of 400 gauss; in normal state; data corrected for magneto-conductivity.
30	452	L	1955	0.40-0.64	2.4	JM 4600; Sn3	Similar to the above specimen but the dia 5.11 mm; in superconducting state.
31	452	L	1955	0.34-0.71	2-4	JM 4600; Sn4	Similar to the above specimen but with tetragonal axis at 88° to the rod axis, and rod dia 2.135 mm; in superconducting state.
32	452	L	1955	0.24-1.2	2-4	JM 4600; Sn5	Pure; polycrystalline; specimen dia 2.315 mm; cast, recrystalized, and strained grain size 0.50 mm; in superconducting state.
33	290	L	1952	1.59		Sn II	99.996 pure; polycrystal with several large crystals; 4.1 mm dia rod; prepared from Johnson-Matthey tin, J.M. Lab No. 2356; electrical resistivity ratio $\rho(273K)/\rho(4.2K)$ ~ 8000; measured in increasing transverse magnetic fields with strength H ranging from zero to 303 gauss.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
34	290	L	1952	1.59		Sn II	The above specimen measured in decreasing transverse magnetic fields with strength H ranging from 246 to 120 gauss.
35	290	L	1952	2.21		Sn II	The above specimen measured in increasing transverse magnetic fields with strength H ranging from zero to 273 gauss.
36	290	L	1952	2.21		Sn II	The above specimen measured in decreasing transverse magnetic fields with strength H ranging from 255 to zero gauss.
37	290	L	1952	2.53		Sn II	The above specimen measured in increasing transverse magnetic fields with strength H ranging from zero to 240 gauss.
38	290	L	1952	2.53		Sn II	The above specimen measured in decreasing transverse magnetic fields with strength H ranging from 149 to zero gauss.
39	290	L	1952	2.18		Sn IV	99.996 pure; single crystal with its tetragonal axis at about 70° from the geometric axis; 4.3 mm dia rod; prepared from Johnson-Matthey tin. J.M. Lab No. 2356; electrical resistivity ratio $\rho(273K)/\rho(4.2K) = 11000$; measured in increasing transverse magnetic fields with strength H ranging from zero to 272 gauss and field direction nearly parallel to the tetragonal axis.
40	290	L	1952	2.18		Sn IV	The above specimen measured in decreasing transverse magnetic fields nearly parallel to the tetragonal axis with strength H ranging from 181 to zero gauss.
41	290	L	1952	2.86		Sn IV	The above specimen measured in increasing transverse magnetic fields with strength H ranging from zero to 204 gauss and field direction at about 20° with the tetragonal axis.
42	290	L	1952	2.86		Sn IV	The above specimen measured in decreasing transverse magnetic fields with strength H ranging from 115 to zero gauss and field direction at about 20° with the tetragonal axis.
43	290	L	1952	3.62		Sn IV	The above specimen measured in transverse magnetic fields with strength H ranging from zero to 2620 gauss and field direction at about 20° with the tetragonal axis.
44	290	L	1952	1.27			99.866 pure; 0.134 Bi; polycrystalline; specimen 5.0 mm in dia; prepared from Johnson-Matthey materials; measured in increasing transverse magnetic fields with strength H ranging from zero to 304 gauss.
45	290	L	1952	1.27			The above specimen measured in decreasing transverse magnetic fields with strength H ranging from 237 to zero gauss.
46	285	L	1952	2.5			Spectroscopically pure; polycrystal with a few large crystals; 3-4 mm dia x ~ 10 cm long; prepared from Johnson-Matthey tin; measured in increasing transverse magnetic fields with strength H ranging from zero to 238.2 gauss.
47	285	L	1952	2.5			The above specimen measured in decreasing transverse magnetic fields with strength H ranging from 149.7 to zero gauss.
48	404, 738	L	1950	2.7-5.6	4	Sn I	99.996$^+$ pure; single crystal; supplied by Johnson-Matthey Co. Ltd.; specimen 8 cm long, 4 mm in dia; in superconducting state below transition temperature.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
49	404, 738	L	1950	2.1-4.7	4	Sn II	Similar to the above specimen but with a dia of 2 mm; in superconducting state below transition temperature.
50	404, 738	L	1950	2.18	4	Sn II	The above specimen measured in longitudinal magnetic fields with strength H ranging from zero to 455.2 gauss.
51	404, 738	L	1950	3.19	4	Sn II	The above specimen measured in longitudinal magnetic fields with strength H ranging from zero to 258.7 gauss.
52	404, 738	L	1950	3.32	4	Sn II	The above specimen measured in longitudinal magnetic fields with strength H ranging from zero to 376.1 gauss.
53	404, 738	L	1950	3.77	4	Sn II	The above specimen measured in longitudinal magnetic fields with strength H ranging from zero to 375.2 gauss.
54	404, 738	L	1950	4.38	4	Sn II	The above specimen measured in longitudinal magnetic fields with strength H ranging from zero to 532 gauss.
55	404, 738	L	1950	5.02	4	Sn II	The above specimen measured in longitudinal magnetic fields with strength H ranging from zero to 434.5 gauss.
56	404, 738	L	1950	2.2-3.7	4	Sn II	The above specimen; superconducting transition point 3.69 K; measured in a magnetic field; in normal state.
57	406	C	1922	313.2	5		Pure; specimen 3 cm long and 3 cm in dia; zinc used as comparative material.
58	431	E	1941	390-460			Single crystal; electrical resistivity reported as 14.45, 15.30, 15.80, 17.55, 18.03 and 18.94 μ ohm cm at 390.2, 404.4, 412.0, 439.5, 447.6, and 460.2 K, respectively.
59	315, 45[illegible]	L	1957	2.4-4.3	2	1	0.197 Bi; 4 mm dia rod; annealed for several months; electrical resistivity reported as 0.0721 and 11.69 μ ohm cm, at 4.2 and 300 K, respectively; measured in a magnetic field of ~560 gauss; in normal state.
60	458	L	1958	2.1-4.0	< 5	Sn 1	99.9 pure, monocrystalline; 1.89 mm dia rod; polished; in superconducting state.
61	458	L	1958	0.11-4.2	< 5	Sn 2	99.998 pure; monocrystalline; 1.72 mm dia rod with rough surface; angle between specimen axis and [001] direction 30°; in superconducting state.
62	458	L	1958	2.3-3.7	5	Sn 2	The above specimen in normal state.
63	458	L	1958	0.12-1.4	< 5	Sn 3	99.998 pure; monocrystalline; 1.40 mm dia rod with rough surface; angle between specimen axis and [001] direction 70°; in superconducting state.
64	458	L	1958	0.11-0.92	5	Sn 4	99.998 pure; monocrystalline; 1.81 mm dia rod with polished surface; angle between specimen axis and [001] direction ~ 45°; in superconducting state.
65	190	L	1953	0.17-0.61		Sn 2	99.997 pure; polycrystalline; effected by "frozen in" magnetic field; in superconducting state.
66	190	L	1953	0.57-0.71		Sn 2	99.997 pure; polycrystalline; in superconducting state.
67	190	L	1953	0.33-0.80		Sn 1	99.997 pure; single crystal; in superconducting state.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
68	459	P	1905	286.7			Chemically pure; specimen in ring form; cast and turned; density 7.31 g cm^{-3} at 14 C; electrical resistivity 11.82 μ ohm cm at 13.5 C; thermal conductivity value calculated from measured data of thermal diffusivity and specific heat.
69	454	L	1958	0.21–0.52	2	E 0	Spectroscopically pure; single crystal; 4.91 mm dia rod with specimen axis at 85° to the tetrad axis; provided by Johnson Matthey Co. Ltd.; cast, crystallized, and electro-polished to 0.05 μ in surface roughness; in superconducting state.
70	454	L	1958	0.21–0.52	2	E 1	The above specimen 50% clouding etched by exposure to HCl fumes; surface roughness 0.3 μ; in superconducting state.
71	454	L	1958	0.26–0.51	2	E 2	The above specimen lightly etched to 0.7 μ in surface roughness; in superconducting state.
72	454	L	1958	0.25–0.53	2	E 3	The above specimen etched to 1.1 μ in surface roughness; in superconducting state.
73	454	L	1958	0.21–0.47	2	E 4	The above specimen electro-polished 0.05 μ in surface roughness and 4.75 mm in dia; in superconducting state.
74	454	L	1958	0.21–0.47	2	E 5	The above specimen 25% clouding etched by exposure to HCl fumes; surface roughness 0.12 μ; in superconducting state.
75	454	L	1958	0.25–0.52	2	E 6	The above specimen electro-polished to 0.10 μ in surface roughness and 3.15 mm in dia; in superconducting state.
76	454	L	1958	0.24–0.53	2	E 7	The above specimen etched to 1.0 μ in surface roughness; in superconducting state.
77	454	L	1958	0.27–0.65	2	E 10	The above specimen electro-polished, etched, annealed at 220 C, then again etched to 1.0 μ in surface roughness and 1.96 mm in dia; residual electrical resistivity 0.00377 μ ohm cm; in superconducting state.
78	454	L	1958	0.24–0.66	2	D 0	Spectroscopically pure; 2.82 mm dia rod consisted of 3 large crystals; as cast; surface roughness 0.10 μ; residual electrical resistivity 0.0014 μ ohm cm; in superconducting state.
79	454	L	1958	0.26–0.63	2	D 1	The above specimen etched to 0.7 μ in surface roughness; in superconducting state.
80	455	L	1953	0.18–0.67	10–25	Sn II	Spectroscopically pure; polycrystalline; 1.3 mm dia rod made up of crystals of the order of the dia; cast in tube; in superconducting state.
81	455	L	1953	0.23–0.90	10–25	Sn III	Similar to the above specimen but with dia 0.7 mm; in superconducting state.
82	682	L	1960	0.13–4.0			0.002 impurity; single crystal; 0.175 cm in dia and ~50 mm long; cast in vacuo in thin-walled glass capillary in which crystallization took place immediately after casting; electrical resistivity ratio $\rho(293K)/\rho_0$ ~ 6250; in superconducting state below transition point.
83	592	L	1959	570–833			In molten state; melting point 231.9 C.
84	597, 708	L	1961	337–610	2–5		99.94 pure; in both solid and liquid states.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
85	509	C	1954	306-378	± 3	56 B-1	Specimen made from NBS freezing-point tin No. 42b (freezing point 231.9 C); 0.500 in. dia x 0.500 in. long; electrolytically deposited pure copper used as comparative material; reference data of copper taken from International Critical Tables (Vol. 5, McGraw Hill Book Co., New York, p. 221, 1929).
86	511	L	1958	298.0			Specimen with radius of 0.7 cm furnished by the manufacturer Erba; measured in atmospheric pressure.
87	504	P	1961	295.2	± 5		Rectangular plate 1.9 x 1.9 x 0.306 cm; supplied by Armco; thermal conductivity value calculated from measured thermal diffusivity using values of density and specific heat taken from Smithsonian Physical Tables (9th ed., 1954).
88	712	L	1961	2.9-4.6		Sn-1	High purity; single crystal; 2.6 mm in dia; specimen axis in the [001] orientation; residual electrical resistivity $\rho_0 = (1 \pm 0.5) \times 10^{-4}$ μ ohm cm; superconducting transition point 3.72 K; measured in a longitudinal magnetic field; in normal state; data corrected to zero field.
89	712	L	1961	1.9-3.7		Sn-1	The above specimen in superconducting state.
90	712	L	1961	2.6-4.4		Sn-2	Similar to the above specimen but 1.1 mm dia and residual electrical resistivity $\rho_0 = (1.65 \pm 0.2) \times 10^{-4}$ μ ohm cm; measured in a longitudinal magnetic field; in normal state; data corrected to zero field.
91	712	L	1961	0.6-3.7		Sn-2	The above specimen in superconducting state.
92	712	L	1961	2.3-4.7		Sn-3	Similar to the above specimen but 1.5 mm in dia and residual electrical resistivity $\rho_0 = 6.1 \times 10^{-4}$ μ ohm cm; measured in a longitudinal magnetic field; in normal state; data corrected to zero field.
93	712	L	1961	2.0-3.7		Sn-3	The above specimen in superconducting state.
94	712	L	1961	2.8-4.5		Sn-4	High purity; single crystal; 2.1 mm in dia; specimen axis in the [110] orientation; residual electrical resistivity $\rho_0 = (1.2 \pm 0.5) \times 10^{-4}$ μ ohm cm; measured in a longitudinal magnetic field.
95	712	L	1961	2.5-3.7		Sn-4	The above specimen in superconducting state.
96	706	L	1881	273, 373			Density 7.27 g cm^{-3}; electrical conductivity reported as 9.346 and 5.524 x 10^4 $ohm^{-1} cm^{-1}$ at 0 and 100 C, respectively.
97	739	L	1961	2.7-4.3		Sn 1	High purity; single crystal; rod specimen about 14 cm long made from 2 mm dia extruded wire; nominal orientation [001]; rod along the tetrad axis; specimen crystallized by slow cooling, etched in concentrated HCl; electrical resistivity ratio $\rho(293K)/\rho_0 = 80000$; measured in a magnetic field; in normal state.
98	739	L	1961	2.8-4.2		Sn 2	Similar to the above specimen but made from 5 parts of Johnson, Matthey Specpure and 8 parts of high purity tin from Vulcan De-tinning Co.; electrical resistivity ratio $\rho(293K)/\rho_0 = 23000$; measured in a magnetic field; in normal state.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
99	739	L	1961	2.7-4.2		Sn 4	Similar to the above specimen but made from equal parts of Johnson, Matthey Specpure and Vulcan De-tinning Co. high purity tin; electrical resistivity ratio $\rho(293K)/\rho_0$ = 4500; measured in a magnetic field; in normal state.
100	740	L	1965	0.34-1.3	< 10		99.99$^+$ pure; single crystal; specimen 2.2 mm in dia and 100 mm long; residual electrical resistivity $\rho(4.2K)$ - 1.7 x 10^{-10} ohm cm in superconducting state.
101	740	L	1965	0.48-1.3	< 10		The above specimen measured in a longitudinal magnetic field of 500 oersteds; in normal state.
102	740	L	1965	0.45-1.2	< 10		The above specimen measured in a transverse magnetic field of 500 oersteds; in normal state.
103	740	L	1965	0.39-1.5	< 10		0.05 mm tin foil produced by rolling tin having the same purity as the above specimen; in superconducting state.
104	740	L	1965	0.42-2.0	< 10		The above specimen measured in a longitudinal magnetic field of 330 oersteds; in normal state.
105	740	L	1965	0.36-1.7	< 10		Similar to the above specimen but the foil had been preliminarily etched; in superconducting state.
106	740	L	1965	0.43-1.4	< 10		The above specimen measured in a longitudinal magnetic field of 330 oersteds; in normal state.
107	735, 839	P	1965	870-1230	6-8		Molten specimen filled in the space between 2 coaxial tantalum tubes of dia 23.8 and 8 mm, each tube 0.12 mm thick; thermal conductivity values calculated from measured data of thermal diffusivity and specific heat using data of density taken from M.P. Slavinskii, (Physicochemical Properties of Elements [Russian] 1952).
108	744	P	1966	465-1365	7		Molten specimen filled in the space between two coaxial thin-walled tantalum tubes of 24 and 8 mm dia, respectively; thermal conductivity values calculated from measured data of thermal diffusivity and specific heat.
109	838	C	1966	429-773			Molten specimen placed in a hole of 21 mm in dia drilled in an asbestos cement cylinder of 30 mm height; 1Kh18N9T steel used as comparative material.
110	837	L	1967	1.6-4.5	1	Sn 1	99.999 pure; supplied by Johnson-Matthey; extruded into 1.5 mm dia wire; electrical resistivity reported as 0.00213 and 13.06 μohm cm at 4.2 and 273 K, respectively; superconducting transition temperature 3.720 K; below the transition temperature, a longitudinal magnetic field was applied to the specimen; in normal state.
111	837	L	1967	1.6-3.6	1	Sn 1	The above specimen measured with the magnetic field removed; in superconducting state.
112	837	L	1967	1.6-4.5	1	Pb 1	0.019 Pb; prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Pb, extruding into 1.5 mm dia wire; annealed at ~200 C for several days; electrical resistivity reported as 0.00564 and 12.71 μohm cm at 4.2 and 273 K, respectively; superconducting transition point 3.716 K; measured in a longitudinal magnetic field; in normal state.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
113	837	L	1967	2.2-3.6	1	Pb 1	The above specimen measured without the magnetic field; in superconducting state.
114	837	L	1967	1.6-4.6	1	Pb 2	0.174 Pb; prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Pb, extruding into 1.5 mm dia wire; annealed at ~200 C for several days; electrical resistivity reported as 0.0500 and 13.19 μ ohm cm at 4.2 and 273 K, respectively; superconducting transition point 3.713 K; measured in longitudinal magnetic field; in normal state.
115	837	L	1967	1.4-3.7	1	Pb 2	The above specimen measured without the magnetic field; in superconducting state.
116	837	L	1967	1.3-4.5	1	Bi 1	0.012 Bi; prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Bi, extruding into 1.5 mm dia wire; annealed at ~200 C for several days; electrical resistivity reported as 0.00578 and 12.61 μ ohm cm at 4.2 and 273 K, respectively; superconducting transition point 3.725 K; measured in a longitudinal magnetic field, in normal state.
117	837	L	1967	1.4-3.7	1	Bi 1	The above specimen measured without the magnetic field; in superconducting state.
118	837	L	1967	1.4-4.4	1	Bi 2	0.140 Bi; prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Bi, extruding into 1.5 mm dia wire; annealed at ~200 C for several days; electrical resistivity reported as 0.0721 and 11.91 μ ohm cm at 4.2 and 273 K, respectively; superconducting transition point 3.709 K; measured in a longitudinal magnetic field; in normal state.
119	837	L	1967	2.2-3.7	1	Bi 2	The above specimen measured without the magnetic field; in superconducting state.
120	837	L	1967	1.6-4.7	1	Hg 1	0.018 Hg; prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Hg, extruding into 1.5 mm dia wire; annealed at ~200 C for several days; electrical resistivity reported as 0.0203 and 12.87 μ ohm cm at 4.2 and 273 K, respectively; superconducting transition point 3.718 K; measured in a longitudinal magnetic field; in normal state.
121	837	L	1967	1.7-3.7	1	Hg 1	The above specimen measured without the magnetic field; in superconducting state.
122	837	L	1967	1.4-4.0	1	Hg 2	0.168 Hg; prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Hg, extruding into 1.5 mm dia wire; annealed at ~200 C for several days; electrical resistivity reported as 0.113 and 11.28 μ ohm cm at 4.2 and 273 K, respectively; superconducting transition point 3.686 K; measured in a longitudinal magnetic field; in normal state.
123	837	L	1967	1.4-3.6	1	Hg 2	The above specimen measured without the magnetic field; in superconducting state.
124	836	L	1958	1.6-4.6	4-5	2	0.047 Hg; prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Hg, casting into 1 mm dia x 12 cm long wire in a pyrex capillary; residual electrical resistivity 0.014 μ ohm cm; measured in a magnetic field; in normal state.
125	836	L	1958	1.6-4.2	4-5	2	The above specimen measured without the magnetic field; in superconducting state.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
126	836	L	1958	1.6-4.8	4-5	5	0.049 Bi; prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Bi, casting into 1 mm dia x 12 cm long wire in a pyrex capillary; residual electrical resistivity 0.020 μ ohm cm; measured in a magnetic field; in normal state.
127	836	L	1958	1.5-2.8	4-5	5	The above specimen measured without the magnetic field; in superconducting state.
128	836	L	1958	1.6-4.9	4-5	8	0.040 Pb; prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Pb, casting into 1 mm dia x 12 cm long wire in a pyrex capillary; residual electrical resistivity 0.010 μ ohm cm; measured in a magnetic field; in normal state.
129	836	L	1958	1.6-2.6	4-5	8	The above specimen measured without the magnetic field; in superconducting state.
130	835	L	1966	1.65	± 4	Sn 5.0	Polycrystalline; 2.25 mm dia x 10 cm long; supplied by Johnson-Matthey and Co.; specimen recrystallized in an alumina packing; annealed at a temperature just below the melting point for several hrs; electrical resistivity ratio $\rho(290K)/\rho(4.2K)$ = 5000; measured in a transverse static magnetic field with strength ranging from 72 to 277 gauss.
131	835	L	1966	1.65	± 4	Sn 5.0	The above specimen measured with the field rotated about the specimen axis 10 times at 5 sec rev^{-1} between points of measurement.
132	835	L	1966	1.80	± 4	Sn 47	Single crystal with tetrad axis at 3 degrees to the specimen axis; 2.15 mm dia x 10 cm long; same preparation procedure as the above specimen; electrical resistivity ratio $\rho(290K)/\rho(4.2K)$ = 47000; measured in a transverse static magnetic field with strength ranging from 76 to 227 gauss.
133	835	L	1966	1.80	± 4	Sn 47	The above specimen measured with the field rotated about the specimen axis 5 times at 8 sec rev^{-1} between points of measurement.

DATA TABLE NO. 61 THERMAL CONDUCTIVITY OF TIN

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, K, Watt $cm^{-1}K^{-1}$]

CURVE 1

T	k
381.2	0.632
398.2	0.623
482.2	0.598
565.2	0.339
690.2	0.331
771.2	0.326

CURVE 2*

T	k
1.41	12.5
1.46	13.0
1.56	14.5
1.66	18.0
1.74	22.5
1.86	27.0
1.91	26.5
1.96	29.5
2.00	35.7
2.05	40.0
2.19	44.5
2.22	44.0
2.36	46.5
2.53	52.5
2.65	57.5
2.67	59.5
2.73	61.5
2.77	61.5
2.81	62.5
2.91	63.5
3.05	66.0
3.23	70.0
3.42	75.5
3.45	74.0
3.56	75.5
3.69	79.5

CURVE 3

T	k
3.83	79.5
3.83	78.0
3.96	73.0
4.07	76.5
4.12	75.0

CURVE 4

T	k
1.32	13.5
1.43	16.1
1.55	19.5
1.80	27.8
2.05	41.0
2.09	42.2
2.18	51.0
2.48	59.5
2.66	64.0
3.14	69.0
3.33	76.5
3.55	80.5
3.62	81.5

CURVE 5

T	k
1.45	42.5
1.95	52.5
2.63	67.0
3.57	70.5
3.66	70.5

CURVE 6

T	k
323.2	0.597
375.2	0.587
420.2	0.582
433.2	0.572
482.2	0.543
537.2	0.341
564.2	0.315
620.2	0.321

CURVE 7

T	k
99.2	0.824
113.2	0.803
123.2	0.791
148.2	0.761
173.2	0.736
199.2	0.720
223.2	0.703
248.2	0.686

CURVE 7 (cont.)

T	k
273.2	0.670
291.2	0.657
303.2	0.649

CURVE 8

T	k
2.34	17.92
2.75	20.15
3.88	24.73
4.12	24.80
4.38	25.05
4.56	24.33
6.18	20.90
8.25	13.01
10.00	8.70
11.55	6.67
14.12	4.23
17.17	3.09
21.55	1.95
23.90	1.87
28.40	1.63
30.83	1.45
33.75	1.40
35.60	1.35

CURVE 9

T	k
2.28	10.00
2.38	11.02
2.72	14.78
2.82	16.57
3.35	20.73
3.42	22.05
3.55	22.50

CURVE 10

T	k
1.82	36.06
2.00	38.70
2.23	42.20
2.56	47.90
2.83	50.73
3.15	52.63

CURVE 10 (cont.)

T	k
3.36	53.30
3.70	55.20
3.80	55.33
3.90	55.33
4.10	54.97
4.37	54.60

CURVE 11

T	k
1.82	17.08
1.90	21.24
2.00	23.43
2.10	26.30
2.16	28.03
2.35	33.43
2.55	38.18
2.65	39.34
2.70	42.04
2.90	43.43
2.95	46.30
3.15	49.00
3.35	52.26
3.50	54.10

CURVE 12

T	k
1.75	2.630
1.90	2.890
2.12	3.080
2.24	3.390
2.42	3.650
2.70	4.100
2.95	4.320
3.10	4.657
3.22	4.820
3.37	5.000
3.52	5.225
3.70	5.400
3.85	5.575
3.95	5.765
4.15	5.925
4.35	6.100

CURVE 13

T	k
1.75	1.080
1.90	1.490
2.12	1.825
2.23	2.220
2.42	2.570
2.70	3.200
2.85	3.430
2.95	3.723
3.03	3.927
3.10	4.290
3.22	4.630
3.38	4.950

CURVE 14*

T	k
308.2	0.650

CURVE 15 (T = 4.4 K)

H (kilooersteds)	k
0.19	23.0
0.29	21.5
0.35	20.9
0.56	18.9
0.73	17.7
1.10	14.0
1.44	12.3
1.80	10.4
2.16	11.2
2.53	8.06
2.86	7.19
3.23	6.58
3.57	6.02

CURVE 16* (T = 3.0 K)

H	k
0.29	17.8
0.35	17.0
0.56	15.1
0.73	13.3

CURVE 16 (cont.) (T = 3.0 K)

H (kilooersteds)	k
1.10	10.5
1.44	8.70
1.80	7.25
2.16	6.13
2.53	5.24
2.86	4.61
3.23	4.12
3.57	3.76

CURVE 17 (T = 2.4 K)

H	k
0.35	14.25
0.56	12.5
0.73	11.1
0.91	9.90
1.10	8.70
1.44	7.09
1.80	5.78
2.16	4.85
2.53	4.17
2.86	3.64
3.23	3.22
3.57	2.94
3.75	2.80

CURVE 18* (T = 2.4 K)

H	k
0.29	16.8
0.35	16.6
0.56	15.5
0.73	14.8
1.10	13.7
1.80	11.1
2.53	9.71
3.23	8.55
3.75	8.13

CURVE 19* (T = 3.0 K)

H (kilooersteds)	k
0.35	19.4
0.73	16.7
1.10	15.1
1.44	14.[illegible]
1.80	13.4
2.16	12.[illegible]
2.53	11.[illegible]
2.86	11.2
3.23	10.6
3.66	10.0

CURVE 20* (T = 4.4 K)

H	k
0.35	24.2
0.73	21.5
1.10	19.3
1.44	18.6
1.80	17.2
2.16	15.6
2.53	14.9
2.86	14.0
3.23	13.6
3.57	13.2
3.75	13.1

CURVE 21* (T = 2.21 K)

H (gauss)	k
62	28.35
122	28.35
180	28.35
204	28.35
206	29.85
217	32.1
244	34.3
270	35.6
292	35.8
366	34.7
487	31.9

CURVE 21 (cont.) (T = 2.21 K)

H (gauss)	k
607	29.8
727	28.2
[illegible]	26.4
[illegible]	25.1
[illegible]	24.1
1213	23.1
1335	22.4
1453	21.7

CURVE 22* (T = 4.29 K)

H	k
62	51.7
113	50.1
186	48.6
244	46.9
305	45.3
366	44.1
487	41.5
607	39.0
734	36.6
851	35.1
969	33.4
1091	32.2
1213	31.1
1335	30.3
1453	29.3

CURVE 23* (T = 2.42 K)

H	k
123	2.58
166	2.58
172	3.01
178	3.51
185	3.63
198	3.66
242	3.66
367	3.66
492	3.66
740	3.66

* Not shown on plot

DATA TABLE NO. 61 (continued)

H	k
CURVE 23* (cont.)	
T = 2.42K	
(gauss)	
970	3.66
1213	3.66
T	**k**
CURVE 24*	
0.39	0.0044
0.405	0.0050
0.44	0.00615
0.47	0.0070
0.47	0.0087
0.50	0.010
0.51	0.0115
0.55	0.0202
0.56	0.0325
0.59	0.0405
0.605	0.0495
0.612	0.0680
0.65	0.100
CURVE 25*	
0.248	0.0050
0.252	0.0053
0.262	0.0050
0.310	0.00715
0.330	0.0079
0.400	0.0100
0.408	0.0110
0.499	0.0194
0.528	0.0220
0.552	0.0230
0.590	0.0335
0.690	0.0420
0.745	0.0595
0.800	0.0895
CURVE 26	
373.2	0.527
CURVE 27	
327	0.632

T	k
CURVE 28	
0.23	0.00245
0.30	0.0047
0.32	0.0059
0.36	0.0072
0.37	0.0083
0.44	0.0140
0.46	0.0165
0.53	0.0255
0.57	0.032
0.66	0.050
0.74	0.079
0.79	0.110
0.84	0.140
0.89	0.195
0.95	0.285
1.0	0.345
1.1	0.730
1.3	1.10
1.4	1.25
1.5	1.55
1.7	1.90
1.8	2.2
1.9	2.5
1.9	2.65
2.0	3.8
2.1	4.4
2.3	4.4
2.3	5.4
2.4	6.7
2.5	6.7
2.5	7.7
2.7	9.0
2.9	12.6
3.1	14.2
3.7	17.0
3.8	21.5
4.2	28.5
CURVE 29	
1.7	10.0
2.0	12.1
2.3	14.0
2.5	16.3
2.7	17.1
2.8	17.0
3.2	18.7
3.5	20.0

T	k
CURVE 30	
0.40	0.0185
0.46	0.0285
0.49	0.032
0.52	0.039
0.51	0.043*
0.57	0.061
0.64	0.100
CURVE 31	
0.34	0.0056
0.36	0.0077
0.36	0.0097
0.41	0.0115
0.43	0.0144
0.45	0.0161
0.46	0.0185
0.51	0.0330
0.55	0.0435
0.58	0.053
0.60	0.063
0.62	0.082
0.66	0.107
0.71	0.135
CURVE 32	
0.24	0.00115
0.32	0.00255
0.36	0.0034
0.40	0.0049
0.42	0.0062
0.48	0.0100
0.53	0.0149
0.56	0.0194
0.58	0.0231
0.67	0.0385
0.76	0.100
0.84	0.195
1.1	0.400
1.2	0.640

H	k
CURVE 33*	
(T = 1.59K)	
(gauss)	
0	14.5
100	14.5
114	14.5
127	12.2
150	10.4
171	10.2
186	8.33
203	10.4
233	24.4
246	24.4
262	22.7
303	20.8
CURVE 34*	
(T = 1.59K)	
246	23.8
203	15.2
190	11.1
149	10.6
135	11.0
120	12.4
CURVE 35*	
(T = 2.21K)	
0	33.2
71	33.1
88	32.9
92	32.5
96	31.1
98	29.7
100	28.7
110	26.7
122	25.0
137	24.4
150	25.1
163	27.0
171	29.9
175	33.3
186	35.0
189	34.8
208	33.3
222	33.1
240	31.8
273	30.4

H	k
CURVE 36*	
(T = 2.21K)	
(gauss)	
255	30.3
212	33.2
185	35.0
164	29.4
149	27.5
135	26.3
123	25.1
105	27.0
95	28.7
82	30.3
76	30.5
0	31.1
CURVE 37*	
(T = 2.53K)	
0	44.8
58	44.6
61	45.0
68	43.7
81	41.5
85	39.5
92	37.7
96	37.5
98	37.5
100	37.5
110	37.5
131	39.0
137	39.7
145	43.3
150	45.5
155	46.1
163	45.7
171	44.4
189	43.7
203	42.2
240	39.2
CURVE 38*	
(T = 2.53K)	
149	46.1
143	45.5
128	41.5
116	38.8
100	37.3

H	k
CURVE 38* (cont.)	
T = 2.53K	
(gauss)	
88	38.6
76	41.5
61	42.9
0	42.9
CURVE 39*	
(T = 2.18K)	
0	33.1
48	32.9
53	32.8
60	32.8
68	32.8
74	32.8
81	32.8
88	32.8
92	32.8
99	32.3
102	28.2
107	26.7
116	25.7
122	25.0
128	24.4
136	24.0
142	23.7
150	23.4
155	23.4
163	24.6
170	26.6
177	29.9
184	33.7
186	33.7
190	33.6
198	33.2
204	33.0
211	32.6
218	32.3
231	31.5
244	31.0
258	30.3
272	29.7

H	k
CURVE 40*	
(T = 2.18K)	
(gauss)	
181	33.4
178	30.5
163	26.5
155	25.4
150	25.1
143	24.8
136	24.8
123	25.1
109	27.0
101	28.7
94	31.5
88	31.9
82	32.1
68	32.3
50	32.4
0	32.4
CURVE 41*	
(T = 2.86K)	
0	46.1
15	45.5
20	45.2
24	45.7
27	45.2
30	44.8
34	45.2
48	45.2
53	45.2
61	42.7
65	41.7
68	41.3
74	40.3
88	39.2
95	39.2
102	40.0
107	41.2
110	43.1
116	43.5
122	43.3
136	41.7
150	40.7
163	39.4
177	39.2
190	38.6
204	37.6

H	k
CURVE 42*	
(T = 2.86K)	
(gauss)	
115	43.9
110	43.9
102	41.3
95	40.7
88	40.0
83	40.5
75	40.8
70	41.3
60	42.4
50	44.8
33	44.8
20	44.8
0	44.8
CURVE 43*	
(T = 3.62K)	
0	6.10
330	6.13
510	6.10
610	6.13
710	6.13
830	6.13
950	6.06
1070	5.99
1110	5.99
1210	6.06
1330	6.10
1440	6.21
1575	6.21
1700	6.13
1875	6.13
2030	6.10
2380	5.95
2620	5.92
CURVE 44	
(T = 1.27K)	
0	0.133
83	0.133*
102	0.133*
112	0.133*
122	0.133*
129	0.133*
138	0.136

* Not shown on plot

DATA TABLE NO. 61 (continued)

CURVE 44 (cont.) (T = 1.27 K)

H (gauss)	k
145	0.142
153	0.152
162	0.157
170	0.162
179	0.168
187	0.185
196	0.200
202	0.213
221	0.262
237	0.408
257	0.526
290	0.535
304	0.535*

CURVE 45* (T = 1.27 K)

H	k
237	0.455
220	0.279
203	0.228
196	0.208
179	0.182
153	0.148
136	0.132
130	0.131
103	0.131
83	0.129
0	0.131

CURVE 46* (T = 2.5 K)

H	k
0	44.4
55	44.4
70.6	44.2
75	43.7
85.3	39.2
92.1	37.6
95	37.3
98.5	37.4
102.3	37.2
109.4	36.8
116.2	36.8
122.9	37.0
129.4	37.5

CURVE 46* (cont.) (T = 2.5 K)

H (gauss)	k
136.2	39.9
143.5	43.9
150	45.6
152.9	46.0
157	45.9
163.2	45.6
170.6	44.7
177.9	44.1
190.6	43.0
205.0	42.1
238.2	39.4

CURVE 47* (T = 2.5 K)

H	k
149.7	46.5
142.6	45.2
129.7	41.2
115.6	38.8
102.3	37.9
88.2	38.9
74.4	42.2
61.2	42.9
0	43.4

CURVE 48

T	k
2.70	30.9
2.92	36.3
2.96	37.0
3.00	38.6
3.16	42.5
3.22	46.7
3.35	44.7
3.61	48.0
3.90	49.6
4.04	53.0
4.17	49.9
4.67	48.8
5.02	46.6
5.09	45.2
5.11	47.7
5.60	35.7

CURVE 49

T	k
2.14	21.7
2.20	21.9
2.40	24.4
2.55	30.0
2.74	30.6*
2.78	31.3
2.82	32.3
2.96	36.2*
2.99	36.6*
3.12	39.2
3.19	41.8
3.21	40.8
3.29	41.3
3.36	42.5
3.41	43.9
3.45	43.1*
3.52	45.7
3.56	44.7*
3.68	47.0
3.79	48.6
3.79	47.5*
3.91	47.9
3.99	49.9
4.13	48.3
4.25	47.6
4.44	47.6
4.61	47.3
4.71	46.2

CURVE 50* (T = 2.18 K)

H (gauss)	k
0	21.5
83.9	21.9
134.0	21.1
165.2	21.9
182.6	21.9
188.3	27.9
191.3	28.1
194.0	29.2
205.0	29.9
208.0	29.2
211.0	29.8
219.0	29.8

CURVE 50* (cont.) (T = 2.18 K)

H (gauss)	k
231.7	28.5
249.0	29.2
259.6	29.2
277.0	28.5
304.3	27.2
316.0	28.5
339.0	27.2
355.0	26.7
359.6	26.4
424.5	25.2
455.2	24.9

CURVE 51* (T = 3.19 K)

H	k
0	41.9
30.2	41.9
52.2	41.9
61.0	42.9
66.5	44.0
71.7	44.0
110.0	43.2
165.2	42.1
221.7	40.8
259.7	39.2

CURVE 52* (T = 3.32 K)

H	k
0	43.8
30.2	44.0
37.0	44.0
43.5	45.0
54.3	45.0
89.1	44.3
110.9	44.3
194.0	42.0
204.0	41.8
310.0	39.0
364.5	38.0
376.1	37.0

CURVE 53* (T = 3.77 K)

H (gauss)	k
0	47.4
53.5	46.5
160.0	44.8
275.0	41.9
343.0	40.5
375.2	39.0

CURVE 54* (T = 4.38 K)

H	k
0	46.9
82.6	44.8
165.2	44.5
221.7	43.5
304.3	41.6
349.6	40.7
422.0	39.3
532.0	36.6

CURVE 55* (T = 5.02)

H	k
0	45.1
110.9	43.9
164.8	43.1
221.0	42.3
326.5	40.3
364.5	39.5
434.5	38.5

CURVE 56*

T	k
2.19	32.3
2.32	34.8
2.45	36.7
3.22	44.6
3.42	45.7
3.52	46.5
3.68	47.1

CURVE 57*

T	k
313.2	0.669

CURVE 58

T	k
390.3	0.799
404.1	0.787
412.0	0.766
439.5	0.745
447.6	0.741
460.2	0.728

CURVE 59

T	k
2.44	0.821
2.69	0.846
2.69	0.905
2.90	0.972
3.15	1.070
3.23	1.090
3.40	1.160
3.53	1.210
3.65	1.230
3.74	1.270
3.86	1.290
3.91	1.320*
3.95	1.340
4.03	1.400
4.12	1.420
4.20	1.420*
4.20	1.380
4.28	1.420

CURVE 60

T	k
2.07	1.95
2.24	2.09
2.58	3.15
2.65	2.80
2.95	3.30*
3.21	4.00
3.48	4.30
3.60	4.40
3.98	5.55

CURVE 61

T	k
0.142	0.000560
0.164	0.000860
0.175	0.00133
0.186	0.00144
0.202	0.00195
0.218	0.00222
0.226	0.00230
0.236	0.00270
0.240	0.00275
0.250	0.00325
0.258	0.00318
0.302	0.00520
0.325	0.00648
0.340	0.00700
0.365	0.00870
0.392	0.00980
0.412	0.0122
0.460	0.0175
0.468	0.0196
0.500	0.0230
0.524	0.0400*
0.570	0.0500*
0.620	0.0645
0.640	0.0780
0.700	0.125
0.705	0.140
0.718	0.155
0.760	0.197
0.800	0.215
0.820	0.336
0.910	0.530
1.00	0.990
1.06	1.74
1.10	1.95
1.35	5.20
1.67	6.90
1.75	8.20
1.90	9.95
2.05	11.00
2.14	12.00
2.27	13.40
2.44	15.60
2.56	17.00
2.68	19.60
2.80	20.00
3.01	22.00
3.20	25.40
3.30	26.00
3.45	26.90
4.20	26.80

* Not shown on plot

DATA TABLE NO. 61 (continued)

T	k
CURVE 62	
2.32	19.8
2.58	22.0
2.74	23.5
3.12	26.7
3.65	29.4
CURVE 63	
0.120	0.00029
0.138	0.00034
0.156	0.00044
0.225	0.00130
0.230	0.00145
0.235	0.00150
0.263	0.00200
0.279	0.00205
0.282	0.00270
0.298	0.00300
0.305	0.00310
0.310	0.00320
0.330	0.00440
0.350	0.00460
0.360	0.00540
0.385	0.00650
0.400	0.00730
0.408	0.00980
0.430	0.0102
0.450	0.0102
0.455	0.0125
0.480	0.0155
0.480	0.0160
0.490	0.0170
0.510	0.0230
0.530	0.0220
0.530	0.0245*
0.540	0.0230
0.540	0.0265*
0.540	0.0320
0.565	0.0320*
0.570	0.0410
0.595	0.0410
0.600	0.0460
0.604	0.0520
0.630	0.0600
0.630	0.0740
0.665	0.0800
0.665	0.0940

T	k
CURVE 63 (cont.)	
0.680	0.110
0.710	0.130
0.755	0.160
0.770	0.210
0.805	0.300
0.840	0.360
0.860	0.395
0.890	0.470
0.890	0.590
0.920	0.740
0.950	0.880
0.980	0.830
1.05	0.980
1.10	1.410
1.12	1.55
1.25	2.45
1.40	4.80
CURVE 64	
0.114	0.00245
0.123	0.00235
0.141	0.00330
0.170	0.00395
0.183	0.00410
0.214	0.00520
0.260	0.00800
0.330	0.0113
0.395	0.0170
0.419	0.0215
0.450	0.0325
0.515	0.0680
0.575	0.125
0.610	0.155
0.630	0.205
0.665	0.265
0.730	0.530
0.800	0.800
0.920	1.350
CURVE 65	
0.47	0.0148
0.48	0.0149
0.545	0.0208
0.555	0.0215
0.57	0.0225

T	k
CURVE 65 (cont.)	
0.58	0.0250
0.59	0.0260
0.60	0.0290
0.61	0.0297
0.623	0.0315
0.64	0.0320
CURVE 66*	
0.565	0.0205
0.580	0.0215
0.590	0.0240
0.610	0.025
0.620	0.026
0.625	0.0294
0.665	0.035
0.705	0.052
CURVE 67	
0.327	0.00105
0.342	0.0012
0.368	0.00125
0.422	0.0017
0.431	0.0020
0.464	0.0023
0.479	0.0025
0.590	0.00305
0.554	0.00506
0.595	0.00875
0.799	0.0188
CURVE 68	
286.7	0.596
CURVE 69	
0.207	0.0049
0.235	0.0071
0.254	0.0092
0.273	0.0109
0.285	0.0128
0.293	0.0148
0.315	0.0149
0.354	0.0168
0.380	0.0230

T	k
CURVE 69 (cont.)	
0.428	0.0285
0.455	0.0410
0.472	0.0560
0.500	0.070
0.515	0.090
CURVE 70*	
0.21	0.00385
0.237	0.0050
0.24	0.0054
0.25	0.0056
0.27	0.00876
0.275	0.00925
0.306	0.0120
0.325	0.0140
0.360	0.0220
0.380	0.0230
0.390	0.0234
0.425	0.0305
0.450	0.0350
0.470	0.0415
0.500	0.0540
0.515	0.0655
CURVE 71*	
0.262	0.0055
0.30	0.0082
0.31	0.00895
0.32	0.0095
0.34	0.0108
0.37	0.0150
0.39	0.0178
0.40	0.020
0.415	0.021
0.45	0.027
0.46	0.030
0.48	0.037
0.50	0.040
0.51	0.0515

T	k
CURVE 72	
0.252	0.00455
0.260	0.0050
0.270	0.0060
0.290	0.0070
0.305	0.00795
0.315	0.0086
0.328	0.00955
0.350	0.0109
0.355	0.0112
0.372	0.0140
0.380	0.0150
0.400	0.0180
0.420	0.0192
0.435	0.0222
0.465	0.0308
0.500	0.0385
0.515	0.0498
0.530	0.0705
CURVE 73	
0.214	0.0053*
0.223	0.0059
0.244	0.00802
0.291	0.0144*
0.297	0.014
0.303	0.0154
0.330	0.0184
0.335	0.020
0.350	0.024
0.372	0.028
0.372	0.030
0.382	0.0335
0.400	0.0355
0.418	0.0388
0.448	0.0473
0.466	0.0550*
CURVE 74*	
0.212	0.00426
0.250	0.00498
0.230	0.00548
0.256	0.00750
0.291	0.0102
0.327	0.0158
0.330	0.0168

T	k
CURVE 74* (cont.)	
0.350	0.0195
0.370	0.0238
0.385	0.0265
0.405	0.0316
0.430	0.0360
0.450	0.0420
0.470	0.0498
CURVE 75*	
0.259	0.00695
0.275	0.00880
0.277	0.00948
0.310	0.0125
0.320	0.0133
0.355	0.0190
0.374	0.0233
0.423	0.0318
0.445	0.0380
0.497	0.0490
0.512	0.0560
0.523	0.0630
CURVE 76*	
0.241	0.00295
0.258	0.00360
0.276	0.00472
0.286	0.00495
0.306	0.00590
0.345	0.0079
0.350	0.0089
0.380	0.012
0.390	0.0123
0.392	0.0133
0.410	0.0147
0.420	0.0153
0.420	0.0180
0.435	0.0184
0.452	0.0237
0.452	0.0285
0.459	0.0335
0.510	0.0450
0.530	0.0600

T	k
CURVE 77*	
0.265	0.00216
0.278	0.00246
0.292	0.00285
0.310	0.00326
0.380	0.00380
0.360	0.00500
0.392	0.00605
0.415	0.0072
0.446	0.0090
0.470	0.0148
0.476	0.0165
0.530	0.0265
0.565	0.0450
0.600	0.0660
0.620	0.0830
0.645	0.0101
CURVE 78*	
0.24	0.00375
0.255	0.00425
0.28	0.00595
0.298	0.00690
0.32	0.0090
0.34	0.0102
0.35	0.0108
0.377	0.0150
0.422	0.0209
0.422	0.0216
0.445	0.0242
0.47	0.0305
0.50	0.0380
0.527	0.0505
0.575	0.0698
0.605	0.0840
0.627	0.0955
0.655	0.102
CURVE 79*	
0.26	0.00225
0.273	0.0031
0.315	0.00425
0.349	0.0062
0.36	0.0071
0.372	0.0080
0.39	0.00975

*Not shown on plot

DATA TABLE NO. 61 (continued)

T	k
CURVE 79* (cont.)	
0.42	0.0122
0.445	0.0160
0.472	0.0212
0.518	0.0328
0.552	0.0505
0.57	0.0525
0.625	0.0827
CURVE 80	
0.176	0.000428
0.210	0.000600
0.250	0.000940
0.347	0.00210
0.470	0.00243
0.650	0.0278
0.670	0.0320
CURVE 81	
0.230	0.00134
0.285	0.00134
0.320	0.00182
0.370	0.00156
0.385	0.00184
0.410	0.00270
0.470	0.00285
0.470	0.00365
0.490	0.00450
0.510	0.00610
0.550	0.00870
0.570	0.0120
0.590	0.0150
0.590	0.0190
0.650	0.0225
0.670	0.0355
0.730	0.0490
0.790	0.0780
0.840	0.127
0.900	0.172
CURVE 82	
0.130	0.000330
0.133	0.000350
0.155	0.000550
0.170	0.000720
CURVE 82 (cont.)	
0.190	0.000900
0.250	0.00205
0.300	0.00350
0.390	0.00750
0.465	0.0130
0.600	0.0350
0.700	0.0950
0.850	0.250
1.05	0.950
1.70	9.80
1.80	12.00
2.40	23.00
2.70	27.50
3.20	35.00
3.40	44.00
3.50	45.00
3.75	45.70
4.00	50.00
CURVE 83	
570.2	0.328
580.2	0.332
615.2	0.337
629.2	0.335*
632.2	0.321
641.2	0.337
648.2	0.323*
656.2	0.346
658.2	0.336*
663.2	0.351*
671.2	0.332*
687.2	0.343
688.2	0.330*
695.7	0.343*
703.2	0.345
707.2	0.346*
713.2	0.335*
718.2	0.349*
722.7	0.357
723.7	0.346*
729.2	0.341*
739.2	0.348
744.7	0.351*
757.2	0.356
766.2	0.358*
771.2	0.349*
CURVE 83 (cont.)	
788.2	0.365
806.2	0.366
833.2	0.371
CURVE 84	
337.2	0.619
370.0	0.615
374.5	0.611
394.6	0.577
401.9	0.586
422.8	0.577
438.7	0.586
450.9	0.590
476.2	0.582
487.6	0.577*
493.7	0.552
514.9	0.318
533.5	0.318
556.9	0.276
584.4	0.289
610.2	0.280
CURVE 85*	
306.4	0.640
330.5	0.632
356.2	0.602
377.7	0.602
CURVE 86	
298.0	0.668
CURVE 87	
295.2	0.669
CURVE 88	
2.85	219.2
3.00	230.8
3.21	214.0
3.35	199.4
3.48	183.2
3.53	168.9
3.58	177.2
3.62	164.5
CURVE 88 (cont.)	
3.69	160.4
3.74	157.8
3.80	157.0
3.92	142.5
4.07	132.1
4.10	127.3
4.22	122.3
4.37	119.7
4.59	108.3
CURVE 89	
1.88	84.0
1.97	80.0
2.06	96.0
2.18	99.2
2.38	113.5
2.60	123.0
2.88	139.0
3.06	159.0
3.20	155.0
3.28	161.0
3.34	149.2
3.46	150.0
3.56	150.0
3.60	142.0
3.71	149.0
CURVE 90	
2.60	247.6
2.85	211.1
3.11	214.5
3.18	202.5
3.27	208.3
3.46	167.1
3.61	171.9
3.69	166.2
3.85	154.0
3.95	141.1
4.02	146.7
4.06	137.6
4.16	130.0
4.26	122.8
4.35	118.5
4.42	116.3
CURVE 91	
0.62	1.00
0.68	1.50
0.74	2.00
0.84	4.00
0.96	5.00
1.11	13.0
1.27	21.0
1.46	39.0
1.86	86.0
1.92	85.0
2.00	95.0
2.09	93.0
2.24	116.0
2.41	124.0
2.59	136.0
2.64	143.0
2.89	155.0
2.92	146.0
3.00	154.0
3.14	162.0
3.24	162.0*
3.32	155.0*
3.45	147.0
3.59	155.0
3.68	154.0
3.69	157.0*
CURVE 92	
2.29	77.7
2.47	76.0
2.87	79.8
3.04	79.0
3.20	78.0
3.38	80.5
3.43	75.3*
3.61	76.8*
3.69	75.0
3.84	73.2*
3.85	74.8
3.98	73.8*
4.03	74.7
4.10	70.7
4.42	65.7
4.72	58.3
CURVE 93	
2.00	30.0
2.04	27.0
2.12	31.0
2.22	34.0
2.29	37.0
2.39	41.0
2.42	44.0
2.48	47.0
2.62	50.0
2.75	53.0
2.85	60.0
2.96	59.4
3.02	60.0
3.14	63.5
3.26	68.0
3.38	68.2
3.55	70.0*
3.68	70.5*
CURVE 94	
2.83	354.0
3.07	330.0
3.23	323.0
3.24	295.0
3.32	316.0
3.49	249.0
3.64	253.0
3.64	243.0
3.71	218.5
3.96	208.5
4.14	202.0
4.29	190.9
4.48	175.8
CURVE 95	
2.46	154.0
2.54	182.0
2.73	204.5
2.86	217.0
3.06	222.5
3.13	224.0
3.25	219.0
3.34	221.0*
3.47	216.0
3.50	213.0*
CURVE 95 (cont.)	
3.60	202.0*
3.60	207.5
3.65	208.0*
CURVE 96*	
273.2	0.639
373.2	0.595
CURVE 97	
2.71	200.7*
2.87	197.9
3.03	183.6
3.16	175.6
3.30	169.2
3.41	162.4
3.50	159.1*
3.60	153.2*
3.68	147.2*
3.79	141.9
3.88	136.1
3.94	131.3
4.02	129.7*
4.07	125.2
4.12	123.0
4.22	117.2
4.28	114.1
CURVE 98*	
2.76	80.0
2.93	78.1
3.11	76.8
3.33	76.6
3.47	75.4
3.61	74.4
3.68	72.9
3.81	71.9
3.92	70.0
4.02	69.3
4.10	67.8
4.16	66.6
4.22	65.9

* Not shown on plot

DATA TABLE NO. 61 (continued)

CURVE 99

T	k
2.71	19.1
2.85	19.9
3.00	20.3
3.16	20.9
3.29	21.4
3.61	22.4
3.71	22.6
3.75	22.7
3.78	22.7
3.82	22.7
3.85	22.6
3.90	22.8
3.97	23.0
3.98	23.0
4.04	24.1
4.07	24.3
4.13	23.1
4.17	23.1
4.19	23.1

CURVE 100*

T	k
0.34	0.0057
0.35	0.0063
0.36	0.0070
0.37	0.0075
0.388	0.0088
0.395	0.0093
0.430	0.0130
0.455	0.0170
0.455	0.0190
0.465	0.0200
0.475	0.025
0.490	0.0295
0.500	0.034
0.505	0.038
0.515	0.046
0.525	0.055
0.535	0.065
0.55	0.080
0.56	0.088
0.565	0.100
0.585	0.125
0.600	0.160
0.620	0.200
0.630	0.230
0.650	0.310

CURVE 100 (cont.)

T	k
0.680	0.400
0.690	0.500
0.71	0.600
0.73	0.750
0.76	1.01
0.77	1.10
0.81	1.60
0.89	2.90
0.99	5.80
1.175	14.00
1.25	20.05
1.325	26.0

CURVE 101

T	k
0.480	35
0.490	31
0.505	34
0.535	40
0.545	41
0.55	38
0.595	44
0.625	44
0.640	46
0.690	56
0.71	50
0.76	57
0.80	60
0.87	62.5
1.03	70
1.15	75
1.39	80

CURVE 102

T	k
0.45	4.40
0.46	4.50
0.465	5.10
0.48	5.00
0.495	5.10
0.505	5.20
0.515	5.40
0.535	5.60
0.55	5.80
0.57	5.90
0.58	6.25
0.61	6.50

CURVE 102 (cont.)

T	k
0.635	6.50
0.65	7.00
0.69	7.50
0.71	7.75
0.72	8.50
0.745	8.00
0.78	8.75
0.78	8.60
0.81	9.25
0.87	10.00
0.90	10.05
1.00	10.15*
1.03	10.20
1.08	10.30*
1.15	10.40
1.23	10.45

CURVE 103*

T	k
0.385	0.00105
0.39	0.0011
0.41	0.0013
0.425	0.0015
0.44	0.0016
0.46	0.0018
0.475	0.00205
0.495	0.00225
0.500	0.00245
0.52	0.0031
0.535	0.0034
0.565	0.0046
0.600	0.00675
0.65	0.012
0.68	0.018
0.69	0.0225
0.71	0.025
0.72	0.038
0.76	0.054
0.80	0.0625
0.82	0.100
0.87	0.125
1.03	0.270
1.18	0.540
1.45	1.35

CURVE 104

T	k
0.42	2.20
0.465	2.60
0.50	2.80
0.60	3.20
0.65	3.20
0.68	3.60
0.74	3.80
0.88	5.10
0.92	5.20
1.08	6.25
1.23	7.50
1.40	8.50
1.60	10.00
1.79	10.50*
2.00	13.00

CURVE 105

T	k
0.36	0.00051
0.37	0.00055
0.38	0.00060
0.39	0.00063
0.40	0.00068
0.415	0.00075
0.43	0.00085
0.445	0.0010
0.455	0.00105
0.48	0.00135
0.49	0.00125
0.50	0.00165
0.52	0.0022
0.545	0.0032
0.56	0.0034
0.59	0.0052
0.63	0.0085
0.67	0.0160
0.71	0.0260
0.76	0.0420
0.82	0.0725
0.89	0.130
0.93	0.180
1.05	0.400
1.08	0.420
1.18	0.675
1.32	1.05
1.48	1.80
1.65	2.90
1.70	3.16

CURVE 106

T	k
0.425	2.85
0.46	2.60*
0.485	2.80
0.585	3.10
0.620	3.20
0.680	4.30
0.770	5.20
0.79	5.00
0.83	5.40
0.99	6.25
1.40	8.00

CURVE 107

T	k
870	0.294
900	0.295
950	0.295
1000	0.297
1050	0.297
1100	0.299
1150	0.300
1200	0.301
1230	0.301

CURVE 108*

T	k
465	0.552
507	0.542
507	0.293
600	0.293
700	0.294
800	0.294
900	0.295
1000	0.295
1100	0.296
1200	0.296
1300	0.297
1365	0.297

CURVE 109*

T	k
429.2	0.6154
473.2	0.6070
495.2	0.5987
524.2	0.3181
572.2	0.3140
635.2	0.3056

CURVE 109 (cont.)*

T	k
722.2	0.3140
773.2	0.3223

CURVE 110

T	k
1.570	15.3*
1.619	15.8*
1.649	16.1
1.702	16.5
1.982	19.3
2.057	20.3
2.161	21.1
2.476	23.0
2.550	24.6
2.689	25.0
2.943	26.4
3.103	27.4*
3.102	28.4
3.197	28.5
3.415	28.7
3.863	30.3
4.178	31.1*
4.255	31.4*
4.266	30.5*
4.330	31.7
4.467	31.5*
4.493	31.2*
4.511	30.5

CURVE 111*

T	k
1.594	4.2
1.637	5.0
1.687	5.8
1.754	6.1
2.030	10.1
2.080	10.7
2.190	11.8
2.498	16.3
2.565	17.6
2.608	18.3
2.697	19.2
2.963	22.2
3.098	23.6
3.126	25.1
3.203	25.6
3.414	27.1
3.572	28.4

CURVE 112

T	k
1.583	6.91
1.684	7.29
1.896	8.25
2.055	8.81
2.138	9.12
2.315	9.77
2.586	10.68
2.637	10.84
2.676	11.07
2.796	11.38
2.993	12.08
3.083	12.24
3.132	12.59
3.250	12.95
3.420	13.30
3.623	13.96
3.821	14.39
3.872	14.65
4.208	15.08
4.252	15.17*
4.301	15.42
4.371	15.36*
4.468	15.35*
4.512	15.66*

CURVE 113

T	k
2.167	4.67
2.295	5.52
2.382	6.17
2.558	6.99
2.623	7.42
2.669	7.85
2.728	8.24
3.010	10.23
3.059	10.19
3.101	10.60
3.187	11.46
3.572	13.56

CURVE 114

T	k
1.606	0.945
1.695	0.998
1.759	1.050
1.993	1.178
2.088	1.189
2.126	1.261

* Not shown on plot

DATA TABLE NO. 61 (continued)

T	k
CURVE 114 (cont.)	
2.223	1.309
2.385	1.418
2.624	1.540
2.675	1.563
2.773	1.620
2.810	1.641*
2.922	1.695
3.050	1.790
3.107	1.790
3.172	1.842
3.222	1.857*
3.274	1.900
3.676	2.140
3.762	2.149*
3.800	2.207
3.896	2.254
4.073	2.351
4.211	2.467
4.238	2.422*
4.283	2.443*
4.329	2.503
4.372	2.524*
4.456	2.551
4.623	2.651
CURVE 115	
1.365	0.169
1.579	0.246
1.644	0.288
1.754	0.360
1.902	0.458
2.034	0.575
2.144	0.645
2.218	0.705
2.327	0.865
2.346	0.822
2.592	1.056
2.612	1.055*
2.670	1.111
2.753	1.218
2.922	1.409
2.996	1.524
3.012	1.483
3.081	1.561
3.115	1.625
3.307	1.810

T	k
CURVE 115 (cont.)	
3.632	2.078
3.684	2.092*
CURVE 116	
1.311	3.39*
1.462	3.80
1.611	4.11
1.683	4.25
1.899	4.80
2.036	5.08
2.073	5.24
2.267	5.58*
2.627	6.40
2.776	6.73
3.095	7.39
3.236	7.58
3.429	7.95
3.574	8.21
3.643	8.31*
3.885	8.61
4.018	8.87
4.080	9.16
4.235	9.33
4.255	9.42*
4.302	9.48
4.376	9.58
4.538	9.67
CURVE 117	
1.421	0.52
1.537	0.93
1.687	1.12
1.741	1.45
1.794	1.54
1.942	2.07
2.032	2.23
2.092	2.50
2.217	2.93
2.504	4.14
2.572	4.20
2.616	4.40
2.690	4.76
3.077	6.07
3.142	6.78
3.608	8.39
3.688	8.39

T	k
CURVE 118	
1.393	0.515
1.468	0.559
1.592	0.606
1.668	0.623
1.766	0.674
1.914	0.726
2.258	0.855
2.284	0.865*
2.465	0.926
2.685	1.023
2.936	1.106
3.138	1.183
3.220	1.216
3.279	1.243*
3.354	1.265
3.620	1.365
3.687	1.397
3.735	1.417*
3.818	1.438
3.924	1.484
3.991	1.513
4.086	1.551
4.285	1.625
4.330	1.637*
4.359	1.644*
4.400	1.666
4.435	1.699
CURVE 119	
2.156	0.426
2.343	0.528
2.418	0.576
2.504	0.631
2.779	0.802
2.825	0.840
2.886	0.883
3.059	1.007
3.142	1.064*
3.184	1.087*
3.276	1.156
3.355	1.205
3.491	1.296*
3.657	1.366*

T	k
CURVE 120*	
1.617	2.18
1.626	2.28
1.705	2.37
2.065	2.84
2.167	2.96
2.336	3.29
2.593	3.55
2.606	3.65
2.802	3.81
2.940	3.97
3.077	4.16
3.180	4.28
3.215	4.28
3.385	4.48
3.600	4.79
3.646	4.83
3.715	4.91
3.736	4.89
3.872	5.11
3.910	5.10
4.127	5.32
4.127	5.36
4.205	5.40
4.227	5.47
4.274	5.47
4.338	5.55
4.375	5.58
4.469	5.66
4.631	5.84
4.641	5.80
4.674	5.85
CURVE 121	
1.658	0.45
1.724	0.59
1.769	0.64
1.802	0.74
2.137	1.31
2.206	1.46
2.348	1.82
2.650	2.41
2.689	2.57
2.765	2.71
3.003	3.38
3.035	3.38*
3.105	3.56
3.201	3.84

T	k
CURVE 121 (cont.)	
3.284	4.08*
3.400	4.34*
3.657	4.82
CURVE 122	
1.397	[illegible]
1.538	0.367
1.665	0.395
1.815	0.427
[illegible]	0.453*
1.990	0.474
2.216	0.528
[illegible]	0.561
[illegible]	0.607
[illegible]	0.636
2.820	0.662
2.988	0.706
3.020	0.712*
3.160	0.748
3.275	0.773
3.391	0.801
3.699	0.877
3.730	0.888
3.789	0.901
3.883	0.921
4.003	0.957
CURVE 123	
1.399	0.106
1.566	0.134
1.836	0.191
2.041	0.248
2.168	0.290
2.275	0.329
2.358	0.348
2.565	0.420
2.749	0.515
2.889	0.559
3.171	0.680
3.188	0.689*
3.303	0.730
3.444	0.791*
3.459	0.798
3.648	0.862*

T	k
CURVE 124*	
1.640	1.17
1.726	1.36
1.789	1.54
1.878	1.76
2.118	2.43
2.220	2.85
2.321	2.93
2.399	3.26
2.588	3.76
2.670	4.00
2.742	4.35
2.766	4.35
2.831	5.02
2.880	5.16
3.069	5.69
3.112	5.86
3.220	6.75
3.318	6.75
3.370	7.07
3.589	7.74
3.682	7.95
3.819	8.48
3.927	9.72
3.985	9.26
4.305	11.84
4.434	12.29
4.627	12.30
CURVE 125*	
1.568	3.51
1.600	3.46
1.636	3.46
1.666	3.64
2.082	4.63
2.130	4.48
2.187	4.63
2.269	4.60
2.588	5.31
2.633	5.65
2.716	5.46
2.785	5.70
2.832	5.76
3.058	5.74
3.101	6.02
3.200	6.78
3.315	7.35
4.207	11.47

T	k
CURVE 126*	
1.584	0.80
1.634	0.95
1.706	1.11
1.812	1.25
1.934	1.39
1.974	1.39
2.028	1.61
2.093	1.73
2.163	1.88
2.240	1.97
2.418	3.25
2.478	3.04
2.595	3.54
2.725	3.95
2.838	4.03
3.060	2.89
3.201	4.66
3.321	4.63
3.506	4.72
3.534	5.05
3.648	5.10
3.736	5.01
3.795	4.96
3.957	5.45
4.159	5.67
4.159	5.79
4.307	6.19
4.484	5.97
4.675	6.38
4.839	6.74
CURVE 127*	
1.534	2.08
1.565	2.47
1.597	2.14
1.655	2.42
1.717	2.33
1.948	2.76
1.992	2.54
2.021	2.82
2.060	2.87
2.139	2.83
2.396	3.91
2.465	3.89
2.524	4.03
2.644	4.16
2.771	4.21

* Not shown on plot

DATA TABLE NO. 61 (continued)

T	k
CURVE 128*	
1.616	1.59
1.675	1.38
1.733	1.94
1.810	2.27
1.885	2.44
2.046	3.39
2.115	3.53
2.146	3.71
2.220	4.04
2.304	4.18
2.541	5.55
2.605	6.31
2.687	5.94
2.769	6.00
2.864	7.05
3.059	6.91
3.145	8.38
3.265	8.00
3.353	8.71
3.499	9.03
3.565	9.03
3.690	9.61
3.823	10.60
3.945	10.93
4.084	11.09
4.348	9.42
4.470	9.46
4.589	11.92
4.709	11.78
4.855	12.01
CURVE 129*	
1.592	4.86
1.615	4.51
1.643	4.63
1.685	4.44
1.720	4.53
2.019	4.92
2.061	5.35
2.080	5.75
2.142	5.35
2.212	5.63
2.534	7.64
2.656	7.02

T	k
CURVE 129 (cont.)*	
2.738	7.41
2.828	7.11

H (gauss)	k
CURVE 130, T = 1.65 K	
72	10.6
90	10.6
111	10.5
119	10.4
128	10.2
139	10.1
147	10.1
159	10.3
175	10.7
184	11.2
195	12.3
204	13.5
213	16.3
225	29.4
244	27.9
277	28.4
261	29.2
231	29.6
222	24.2
212	18.9
204	16.2
194	14.2
185	12.9
175	12.0
166	11.3
157	10.8
148	10.5
137	10.2
126	10.2
102	10.3
84	10.3
CURVE 131*, T = 1.65 K	
85	10.8
110	10.7
132	10.3

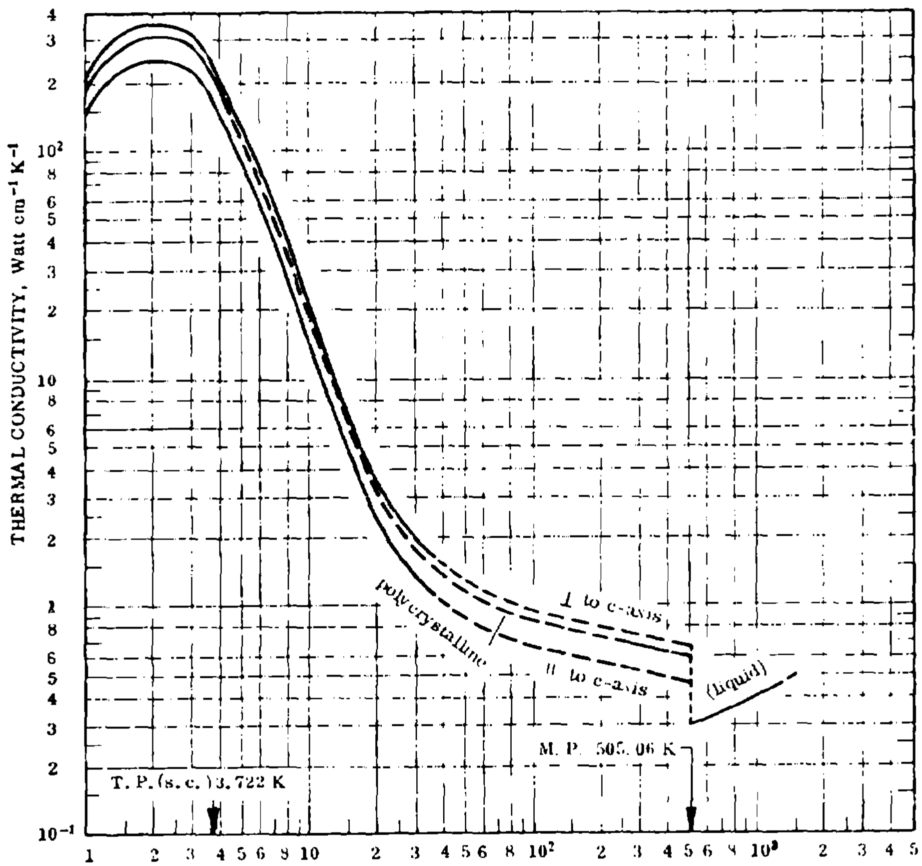
H (gauss)	k
CURVE 131 (cont.)*	
156	9.99
169	10.1
177	10.5
185	10.7
194	11.7
204	13.6
204	27.5
231	30.9
267	31.5
240	31.2
223	28.7
214	18.6
206	14.6
186	11.0
176	10.4
171	10.3
159	10.0
146	10.1
120	10.7
96	10.8
73	10.8
CURVE 132, T = 1.80 K	
76	55.9
92	56.2*
111	56.2*
116	56.2*
119	36.1*
126	24.8*
134	21.8*
142	19.6
149	18.0
158	16.6
167	15.5
176	14.7
186	14.3
195	14.2*
204	14.7*
210	19.1*
213	29.9
217	34.1
227	31.9
222	33.2*
213	34.6*

H (gauss)	k
CURVE 132 (cont.)	
210	35.0*
207	35.2*
204	22.0
195	17.6*
192	16.8*
186	16.1*
177	15.8*
168	15.9*
158	16.8*
149	18.2*
140	19.9
130	22.6*
121	27.4*
111	42.6
104	52.9
96	54.1*
CURVE 133*, T = 1.80 K	
119	33.0
126	25.9
134	21.9
141	19.1
149	17.2
159	15.6
167	14.5
177	13.7
185	13.1
195	12.8
201	12.8
205	14.5
211	27.9
215	33.7
221	33.2
229	32.1
219	33.2
213	33.9
210	32.5
205	23.4
201	19.8
198	17.5
193	16.1
186	15.2
177	15.0
167	15.4

H (gauss)	k
CURVE 133 (cont.)*	
159	15.9
150	17.0
139	19.0
130	21.8
121	28.5
111	54.6
103	56.2
81	56.2

*Not shown on plot

FIGURE AND TABLE NO. 61R RECOMMENDED THERMAL CONDUCTIVITY OF TIN



REMARKS

The recommended values are for well-annealed 99.999^{+}% pure white tin with residual electrical resistivity ρ_0 = 0.000120, 0.000172, and 0.000133 $\mu\Omega$ cm, respectively, for single crystal along directions perpendicular and parallel to the c-axis and for polycrystalline tin (characterization by ρ_0 becomes important at temperatures below about 150 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature and 3 to 15% at other temperatures.

RECOMMENDED VALUES*

	Single Crystal (⊥ to c-axis)		Single Crystal (// to c-axis)		Polycrystalline		
T_1	k_1	k_2	k_1	k_2	k_1	k_2	T_2
0	0	0	0	0	0	0	-459.7
1	204	11800	142	8200	183	10600	-457.9
2	360	20800	250	14400	323	18700	-456.1
3	331	19100	230	13300	297	17200	-454.3
4	202	11700	140	8090	181	10500	-452.5
5	130	7510	90	5200	(117)	(6760)	-450.7
6	85	4910	59	3410	(76)	(4390)	-448.9
7	58	3350	40	2310	(52)	(3000)	-447.1
8	40	2310	28	1620	(36)	(2080)	-445.3
9	29	1680	20.1	1160	(26)	(1500)	-443.5
10	21.5	1240	14.9	861	(19.3)	(1120)	-441.7
11	16.5	953	11.4	659	(14.8)	(855)	-439.9
12	12.9	745	9.0	520	(11.6)	(670)	-438.1
13	10.4	601	7.2	416	(9.3)	(537)	-436.3
14	8.5	491	5.9	341	(7.6)	(439)	-434.5
15	7.0	404	4.9	283	(6.3)	(364)	-432.7
16	5.9	341	4.1	237	(5.3)	(306)	-430.9
18	4.5	260	3.1	179	(4.0)	(231)	-427.3
20	3.6	208	2.5	144	(3.2)	(185)	-423.7
25	2.5	144	1.72	99.4	(2.22)	(128)	-414.7
30	2.0	116	1.36	78.6	(1.76)	(102)	-405.7
35	1.67	96.5	1.16	67.0	(1.50)	(86.7)	-396.7
40	(1.50)‡	(86.7)	(1.04)	(60.1)	(1.33)	(76.8)	-387.7
45	(1.37)	(79.2)	(0.95)	(54.9)	(1.23)	(71.1)	-378.7
50	(1.28)	(74.0)	(0.89)	(51.4)	(1.15)	(66.4)	-369.7
60	(1.16)	(67.0)	(0.80)	(46.2)	(1.04)	(60.1)	-351.7
70	(1.07)	(61.8)	(0.74)	(42.8)	(0.96)	(55.5)	-333.7
80	(1.02)	(58.9)	(0.71)	(41.0)	(0.91)	(52.6)	-315.7
90	(0.98)	(56.6)	(0.68)	(39.3)	(0.88)	(50.8)	-297.7
100	(0.95)	(54.9)	(0.66)	(38.1)	(0.85)	(49.1)	-279.7
150	(0.867)	(50.1)	(0.602)	(34.8)	(0.779)	(45.0)	-189.7
200	(0.816)	(47.1)	(0.567)	(32.8)	(0.733)	(42.4)	- 99.7
250	(0.775)	(44.8)	(0.538)	(31.1)	(0.696)	(40.2)	- 9.7
273.2	(0.759)	(43.9)	(0.527)	(30.5)	0.682	39.4	32.0
300	(0.742)	(42.9)	(0.515)	(29.8)	0.666	38.5	80.3
350	(0.715)	(41.3)	(0.496)	(28.7)	0.642	37.1	170.3
400	0.693	40.0	0.481	27.8	0.622	35.9	260.3
500	0.664	38.4	0.461	26.6	0.596	34.4	440.3
505.06	0.662	38.3	0.460	26.6	0.595	34.4	449.44

*T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡Values in parentheses are extrapolated, interpolated, or estimated.

TABLE NO. 61R (continued)

In Liquid State

T_1	k_1	k_2	T_2
505.06	0.303	17.5	449.44
600	0.323	18.7	620.3
700	0.343	19.8	800.3
800	0.364	21.0	980.3
900	0.384	22.2	1160
1000	0.405	23.4	1340
1100	0.425	24.6	1520
1200	0.446	25.8	1700
1300	0.466	26.9	1880
1400	(0.487)‡	(28.1)	2060
1500	(0.507)	(29.3)	2240

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

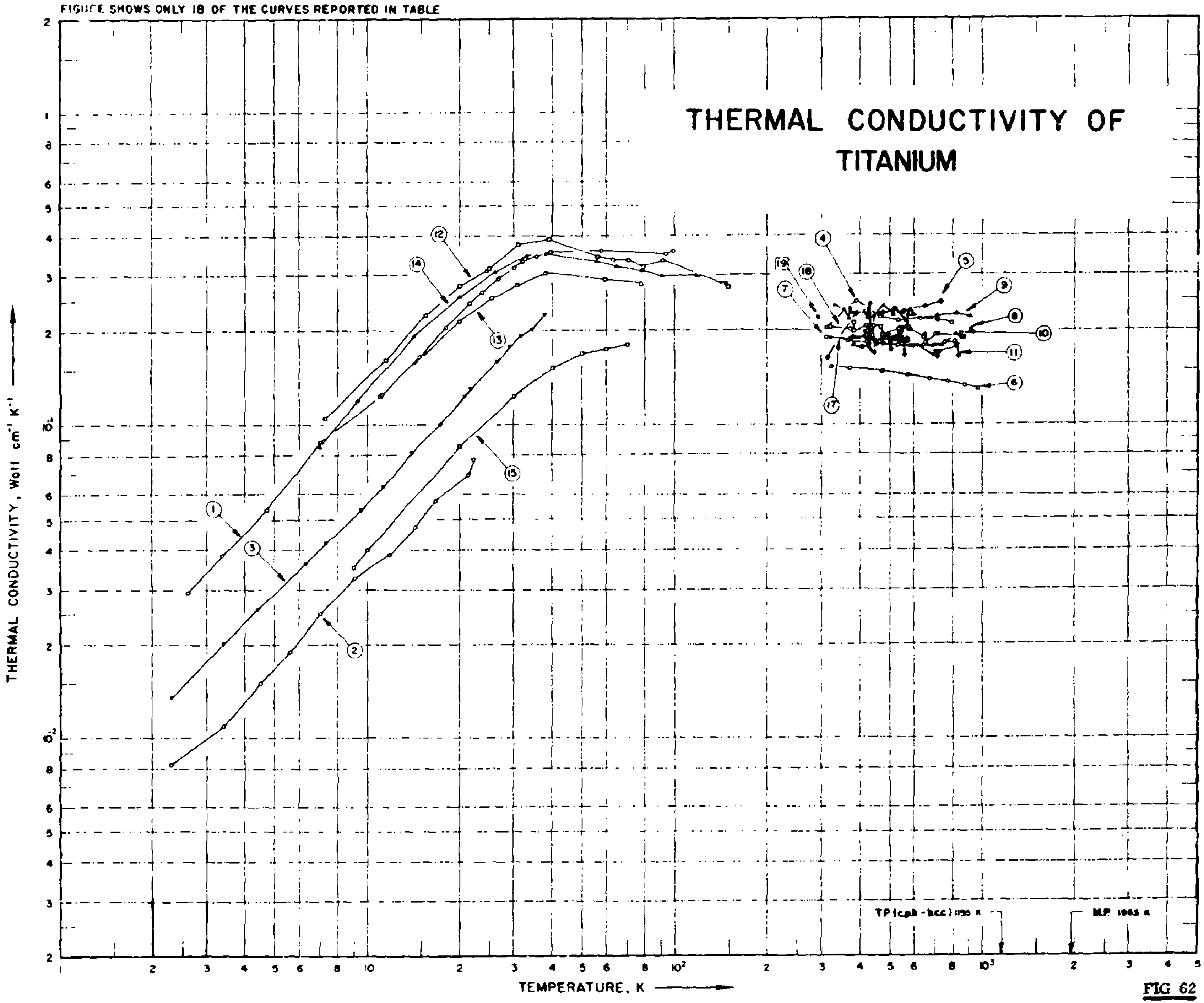


FIGURE SHOWS ONLY 18 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF TITANIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
TP (cph - bcc) 1156 K
M.P. 1943 K
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
17
18
19

FIG 62

SPECIFICATION TABLE NO. 62 THERMAL CONDUCTIVITY OF TITANIUM

(Impurity <0.20% each; total impurities <0.50%)

[For Data Reported in Figure and Table No. 62]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	122	L	1955	2.6-99	5-10	Ti 3	99.99 pure; single crystal.
2	97	L	1952	2.3-22	2-3	Ti 1	99.9 pure; polycrystalline; supplied by Associated Electrical Industries Research Laboratories.
3	97	L	1952	2.3-38	2-3	Ti 2	99.99 pure; polycrystalline; same supplier as above; annealed.
4	441		1957	312-799	3	Iodide Titanium	99.9 pure; annealed in vacuum at 700 C for 5 hrs; electrical resistivity reported as 53.8, 50.3, 67.2, 79.0, 90.0, 100.2, and 115.0 μohm cm at 38.9, 116.0, 196.0, 264.0, 259.3, 445.7, and 526.0 C, respectively.
5	441		1957	315-732			Forged titanium specimen 99.6 pure; annealed in vacuum at 700 C for 5 hrs; electrical resistivity reported as 65.8, 58.8, 73.5, 84.0, 98.2, and 107.5 μohm cm at 41.5, 126.6, 201.6, 278.3, 376.6, and 459.0 C, respectively.
6	131	C	1953	323-973	2		0.1 Mn, 0.04 Fe, 0.035 C, and 0.01 Mg; annealed at 700 C; Advance (55 Cu-45 Ni) used as comparative material.
7	231, 304	C	1958	311-811	< 5	A-55 (RC-55)	Commercially pure; in a mill-annealed condition; electrical resistivity reported as 52, 63, 72, 83, 92, 101, 110, 118, 125, and 132 μohm cm at 311, 366, 422, 477, 533, 589, 644, 700, 755, and 811 K, respectively; measured in a vacuum of 5×10^{-5} mm Hg.
8	742	E	1964	388-923			99.6 pure (Russian commercial titanium); obtained from the Central Boiler and Turbine Institute; specimen 5 mm in dia and 100 mm long; experiment carried out in vacuum (10^{-4} - 10^{-5} mm Hg); electrical resistivity reported as 47, 64, 82, 99, 117, 133, 143 and 145 μohm cm at 0, 100, 200, 300, 400, 500, 600 and 650 C, respectively.
9	340	L	1956	332-915	10	Ti 75 A(1)	Commercially pure; 0.75 in. dia rod.
10	340	L	1956	383-858	10	Ti 75 A(2)	99.75 Ti, 0.131 C, 0.07 Fe, 0.06 C, 0.048 N, and 0.0068 H; 0.75 in. dia rod.
11	340	L	1956	375-838	10	RC-55	99.64 Ti, 0.123 O, and 0.12 Fe, 0.0073 H, 0.08 C, and 0.028 N; 0.75 in. dia rod.
12	401	L	1959	7.3-150		Ti 3	99.99 pure; specimen cross section 3.1 x 1.6 mm; supplied by Winegard; annealed in vacuum for 60 hrs at 800 C; ideal electrical resistivity reported as 0.020, 0.075, 0.20, 0.65, 1.4, 2.3, 3.5, 4.85, 6.35, 7.9, 11.2, 14.8, 18.5, 22.1, 25.7, 29.3, 34.8, 39.0, and 43.1 μohm cm at 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 220, 250, 273, and 295 K, respectively; electrical resistivity ratio ρ_{295K}/ρ_0 = 21.9; Lorenz function $2.74 \times 10^{-8} V^2 K^{-2}$ near 0 K.
13	401	L	1959	11-78		Ti 4	99.99 pure; as rolled; electrical resistivity ratio ρ_{295K}/ρ_0 = 16.4; ideal electrical resistivity 43.8 μohm cm at 295 K; Lorenz function $2.81 \times 10^{-8} V^2 K^{-2}$ near 0 K.
14	401	L	1959	7.0-147		Ti 5	99.99 pure; annealed in vacuum for 60 hrs at 800 C; electrical resistivity ratio ρ_{295K}/ρ_0 = 18.3; ideal electrical resistivity 43.2 μohm cm at 295 K; Lorenz function $3.14 \times 10^{-8} V^2 K^{-2}$ near 0 K.
15	672	±P	1964	9-70			99.9 pure; data taken from smoothed curve.

SPECIFICATION TABLE NO. 62 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
16	683	L	1963	0.3-0.9			Single crystal.
17	698	L,C	1961	323-573		Sample A	Normal commercial grade; electrical resistivity reported as 56.0, 65.0, 73.5, 82.5, 90.5 and 98.5 μohm cm at 50, 100, 150, 200, 250, and 300 C, respectively; energy flow measured both calorimetrically and by using Armco iron as a comparative material.
18	698	L,C	1961	323-573		Sample B	High purity grade; electrical resistivity reported as 51.8, 60.8, 70.0, 79.2, 88.4, and 97.5 μohm cm at 50,100,150, 200, 250, and 300 C, respectively; energy flow measured both calorimetrically and by using Armco iron as a comparative material.
19	698	L,C	1961	293.2		Sample C	Very high purity grade; DPN (Diamond Pyramid Hardness Number) 58-62; electrical resistivity 42.7 μohm cm at 20 C; energy flow measured both calorimetrically and by using Armco iron as a comparative material.

DATA TABLE NO. 62 THERMAL CONDUCTIVITY OF TITANIUM

(Impurity <0.20% each; total impurities <0.50%)

[Temperature, T K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

CURVE 1

T	k
2.60	0.0293
3.38	0.0384
4.70	0.0536
7.01	0.0880
11.17	0.125
14.80	0.167
18.20	0.205
21.56	0.245
23.64	0.266
26.75	0.293
30.10	0.317
32.20	0.333
35.70	0.347
39.50	0.356
57.70	0.361
93.80	0.351
98.70	0.358

CURVE 2

T	k
2.30	0.0083
3.41	0.0109
4.51	0.0150
5.61	0.0188
7.03	0.0250
9.10	0.0326
11.87	0.0386
14.40	0.0475
16.76	0.0571
21.21	0.0695
22.36	0.0774

CURVE 3

T	k
2.31	0.0136
3.41	0.0202
4.40	0.0259
6.32	0.0362
7.32	0.0421
8.58	0.0533
11.32	0.0639
13.98	0.0815
17.27	0.100

CURVE 3 (cont.)

T	k
20.90	0.124
21.76	0.130
26.60	0.160
29.12	0.178
31.60	0.192
34.40	0.201
37.70	0.225

CURVE 4

T	k
312.1	0.205
389.2	0.247
469.2	0.221
537.2	0.215
632.5	0.217
718.9	0.215
799.2	0.210

CURVE 5

T	k
314.7	0.164
389.8	0.227
474.8	0.227
551.5	0.229
649.8	0.238
732.2	0.245

CURVE 6

T	k
323.2	0.154
373.2	0.152
473.2	0.148
573.2	0.144
673.2	0.140
773.2	0.137
873.2	0.133
973.2	0.129

CURVE 7

T	k
311	0.189
366	0.185
422	0.182

CURVE 7 (cont.)

T	k
[illegible]	0.180
533	0.178
589	0.177
644	0.178
700	0.178
755	0.182
811	0.183

CURVE 8

T	k
388.2	0.178
408.2	0.177
456.2	0.183
558.2	0.178
693.2	0.178
738.2	0.178
868.2	0.193
870.2	0.189
923.2	0.202

CURVE 9

T	k
332.3	0.240
356.2	0.231
369.3	0.217
370.7	0.236
374.8	0.229
417.3	0.228
423.4	0.219
427.6	0.235
431.8	0.244
432.3	0.186
447.1	0.221
478.4	0.240
515.1	0.225
516.5	0.234
523.4	0.234
567.9	0.215
570.7	0.208
576.2	0.225
585.1	0.233

CURVE 9 (cont.)

T	k
596.2	0.225
669.6	0.219
679.0	0.219
715.4	0.222
826.2	0.225
915.1	0.221

CURVE 10

T	k
383.2	0.213
384.5	0.197
420.7	0.206
420.7	0.191
440.1	0.190
442.9	0.206
470.7	0.205
475.7	0.193
540.1	0.200
547.1	0.196
547.1	0.200
547.1	0.204
579.0	0.204
581.2	0.200
648.4	0.188
653.4	0.192
655.4	0.182
709.0	0.193
717.3	0.193
858.2	0.188
858.2	0.195

CURVE 11

T	k
374.8	0.189
412.9	0.190
412.9	0.197
422.9	0.186
426.2	0.177
445.1	0.169
445.7	0.165
458.2	0.178
482.3	0.195
491.5	0.193

CURVE 11 (cont.)

T	k
504.6	0.173
504.6	0.186
537.9	0.183
540.7	0.195
546.2	0.187
559.6	0.166
559.6	0.182
609.6	0.177
616.5	0.177
693.2	0.166
701.2	0.170
712.3	0.168
715.7	0.161
724.0	0.170
821.2	0.176
830.4	0.178
837.9	0.164

CURVE 12

T	k
7.3	0.105
11.5	0.163
15.5	0.225
20.0	0.277
24.5	0.310
25.0	0.315
31.0	0.378
39.0	0.390
56.0	0.345
63.0	0.338
71.3	0.335
79.0	0.320
91.7	0.335
150.0	0.276

CURVE 13

T	k
11.0	0.124
20.0	0.215
25.5	0.255
30.7	0.280
38.3	0.305
59.6	0.290
78.0	0.282

CURVE 14

T	k
7.0	0.085
9.3	0.120
14.3	0.193
20.0	0.257
26.0	0.308
33.0	0.347
38.0	0.351
56.0	0.333
65.0	0.320
78.5	0.310
91.0	0.299
117.0	0.300
147.0	0.281

CURVE 15

T	k
9	0.035
10	0.04
20	0.085
30	0.123
40	0.153
50	0.17
60	0.175
70	0.18

CURV[illegible]

T	k
0.378	0.000970
0.398	0.00105
0.410	0.00111
0.442	0.00122
0.478	0.00139
0.535	0.00160
0.580	0.00168
0.620	0.00173
0.680	0.00186
0.730	0.00202
0.780	0.00222
0.830	0.00263

CURVE 17

T	k
323.2	0.1885
373.2	0.1875

CURVE 17 (cont.)

T	k
423.2	0.1865
473.2	0.186
523.2	0.185
573.2	0.184

CURVE 18

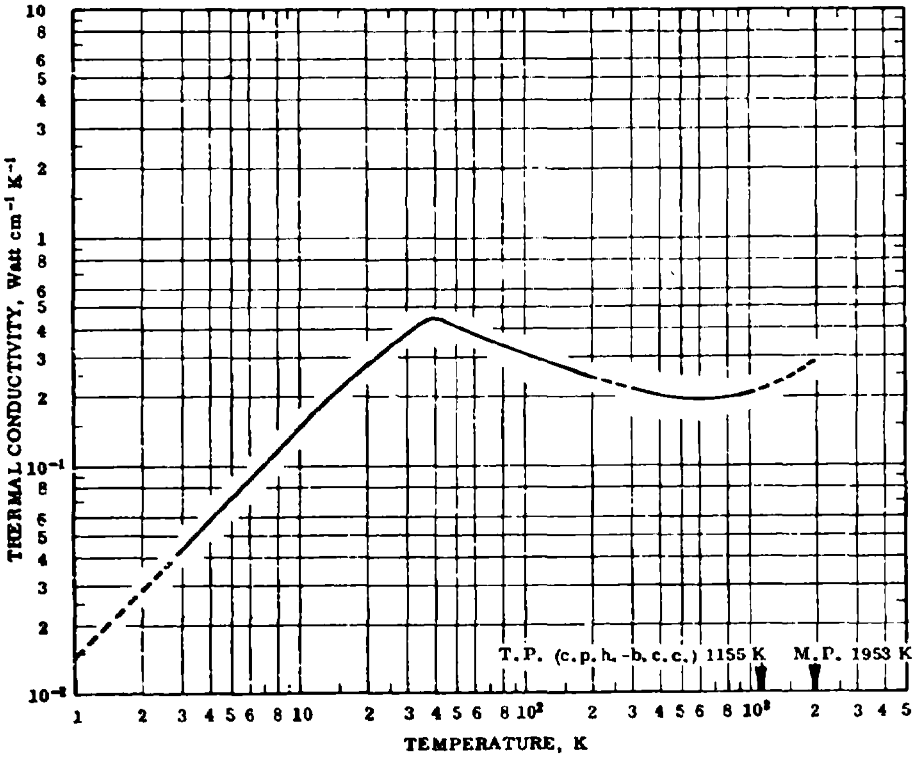
T	k
323.2	0.205
373.2	0.201
423.2	0.197
473.2	0.1925
523.2	0.189
573.2	0.1855

CURVE 19

T	k
293.2	0.220

* Not shown on plot

FIGURE AND TABLE NO. 62R RECOMMENDED THERMAL CONDUCTIVITY OF TITANIUM



RECOMMENDED VALUES[*]
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.197	11.4	440.3
1	(0.0144)[‡]	(0.832)	-457.9	600	0.194	11.2	620.3
2	(0.0288)	(1.66)	-456.1	700	0.194	11.2	800.3
3	0.0432	2.50	-454.3	800	0.197	11.4	980.3
4	0.0576	3.33	-452.5	900	0.202	11.7	1160
5	0.0719	4.15	-450.7	1000	(0.207)	(12.0)	1340
6	0.0863	4.99	-448.9	1100	(0.213)	(12.3)	1520
7	0.101	5.84	-447.1	1200	(0.220)	(12.7)	1700
8	0.115	6.64	-445.3	1300	(0.228)	(13.2)	1880
9	0.129	7.45	-443.5	1400	(0.236)	(13.6)	2060
10	0.144	8.32	-441.7	1500	(0.245)	(14.2)	2240
11	0.158	9.13	-439.9	1600	(0.253)	(14.6)	2420
12	0.172	9.94	-438.1	1700	(0.262)	(15.1)	2600
13	0.186	10.7	-436.3	1800	(0.271)	(15.7)	2780
14	0.200	11.6	-434.5	1900	(0.280)	(16.2)	2960
15	0.214	12.4	-432.7				
16	0.227	13.1	-430.9				
18	0.254	14.7	-427.3				
20	0.279	16.1	-423.7				
25	0.337	19.5	-414.7				
30	0.382	22.1	-405.7				
35	0.411	23.7	-396.7				
40	0.422	24.4	-387.7				
45	0.416	24.0	-378.7				
50	0.401	23.2	-369.7				
60	0.377	21.8	-351.7				
70	0.356	20.6	-333.7				
80	0.339	19.6	-315.7				
90	0.324	18.7	-297.7				
100	0.312	18.0	-279.7				
150	0.270	15.6	-189.7				
200	(0.245)	(14.2)	- 99.7				
250	(0.229)	(13.2)	- 9.7				
273.2	(0.224)	(12.9)	32.0				
300	0.219	12.7	80.3				
350	0.210	12.1	170.3				
400	0.204	11.8	260.3				

REMARKS

The recommended values are for well-annealed 99.99+% pure titanium with residual electrical resistivity $\rho_0 = 1.70\ \mu\Omega$ cm (characterization by ρ_0 becomes important below room temperature). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.6, $\alpha' = 4.32 \times 10^{-5}$, and $\beta = 69.5$. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

[*] T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

[‡] Values in parentheses are extrapolated, interpolated, or estimated.

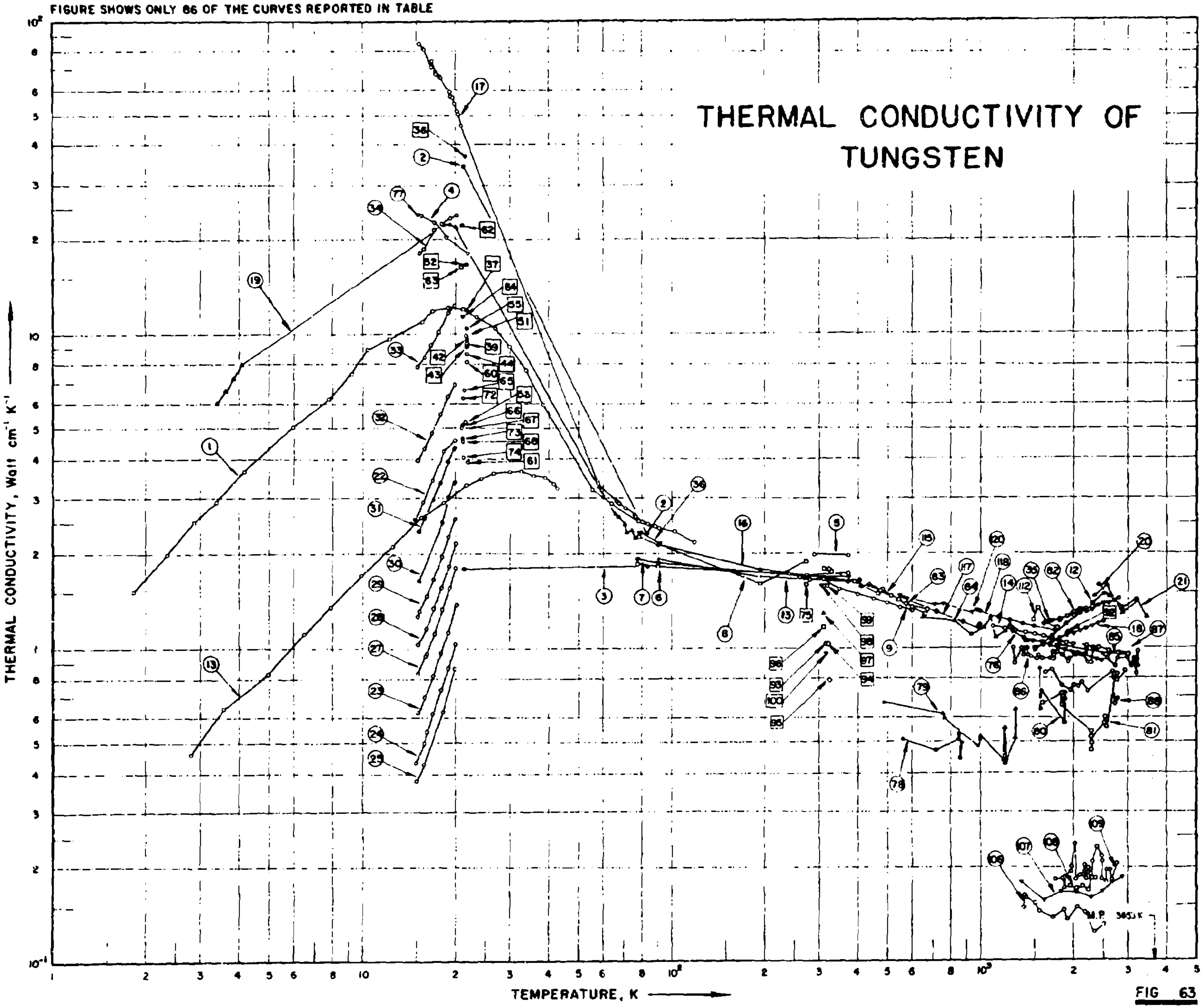


FIGURE SHOWS ONLY 86 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF TUNGSTEN
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
M.P. 3653 K

FIG 63

SPECIFICATION TABLE NO. 63 THERMAL CONDUCTIVITY OF TUNGSTEN

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 63]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	150	L	1957	1.8-119		W 1b	0.01 Mo, traces of Fe, Si and Cu; 4 mm dia rod; annealed in vacuum at 1350 C; electrical resistivity ratio $\rho(295K)/\rho_0 = 169$; residual electrical resistivity 0.0315 μohm cm.
2	57	L	1927	21, 83		W 1	High purity; single crystal; electrical resistivity reported as 0.00589 and 0.681 μohm cm at -252 and -190 C, respectively.
3	57	L	1927	21, 83		W 2	Less pure than the above specimen; single crystal; electrical resistivity reported as 0.266, 1.024, and 5.29 μohm cm at -252, -190, and 0 C, respectively.
4	16	L	1936	16-22			Very pure; electrical resistivity ratio $\rho(273K)/\rho_0 = 2.18 \times 10^3$.
5	8	F	1914	290, 373		Pladuram	Pure; 0.0600 cm dia x 28.5 cm long; electrical resistivity reported as 5.206 and 7.562 μohm cm at 0 and 100 C, respectively.
6	24	E	1943	77-373		2	High purity; 0.0250 cm dia x 40.85 cm long; drawn; aged at 2400 and 2600 C; electrical resistivity reported as 0.6736, 0.9132, 3.18, 5.034, and 7.392 μohm cm at 77.4, 90.2, 193, 273.2, and 372.8 K, respectively.
7	24	E	1943	77-373		8	High purity; 0.0250 cm dia x 40.00 cm long; drawn; aged at 2300 C; electrical resistivity reported as 0.6135, 0.8558, 5.035, and 7.429 μohm cm at 77.36, 90.2, 273.2, and 373.1 K, respectively.
8	99	E	1936	78-273			Commercially pure; 0.00254 cm dia x 14.8 cm long; aged at white heat for several hrs in vacuum, etched; Lorenz function reported as 2.12, 2.68, and 3.48 $V^2 K^{-2}$ at 78, 194, and 273 K, respecitvely; measured in a vacuum of $< 10^{-6}$ mm Hg.
9	87	E	1936	240-600			Pure; 0.00499 cm dia wire; annealed at 2400 K; data taken from smoothed curve.
10	78	E	1931	276-280	2		Commercially pure; 0.1022 cm dia x 17.63 cm long; supplied by General Electric Co.; annealed at 220 C; electrical conductivity 16.7×10^4 ohm^{-1} cm^{-1} at 273 K; measured in a vacuum of $< 10^{-4}$ mm Hg.
11	78	E	1931	276-286	2		Commercially pure; 0.1022 cm dia x 19.96 cm long; supplied by General Electric Co.; annealed at 1300 C; electrical conductivity 17.7×10^4 ohm^{-1} cm^{-1} at 273 K; measured in a vacuum of $< 10^{-4}$ mm Hg.
12	153	E	1914	1500-2500			Pure; 0.0209 cm dia filament; data taken from smoothed curve.
13	97	L	1952	2.8-43	2-3	JM2260; W1	99.99 pure; polycrystalline; annealed.
14	106	E	1941	1100-2000			Traces of metallic impurities; aged at 2700 K for 2 hrs; electrical resistivity reported as 30.0, 35.5, 42.3, 49.4, 58.2, and 66.6 μohm cm at 1180, 1350, 1570, 1800, 2050, and 2300 K, respectively; data taken from smoothed curve.
15	79	E	1933	90-373		W	99.96$^+$ W, traces of Si, Ta and V; single crystal; 7.846 cm x 0.01053 cm^2; electrical resistivity reported as 0.892, 3.22, 4.98, and 7.35 μohm cm at -183.00, -78.50, 0, and 100 C, respectively; heat flow parallel to crystal axis.

SPECIFICATION TABLE NO. 63 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
16	79	E	1933	90-373		W2	99.96$^+$ W, traces of Si, Ta and V; single crystal; 7.940 cm x 0.01022 cm^2; electrical resistivity reported as 0.843, 3.17, 4.94, and 7.29 μohm cm at -183.00, -78.50, 0, and 100 C, respectively; heat flow at 45 degrees to the crystal axis.
17	62	L	1938	15-88			High purity; single crystal; specimen axis in [111] direction; electrical resistivity reported as 0.00236, 0.00315, 0.00417, 0.00422, 0.1425, 0.3230, 0.3475, 0.3565, 0.3945, 0.4230, 0.4460, 0.4990, 0.5110, 0.5595, 0.6065, 0.7040, and 0.8070 μohm cm at 14.14, 17.55, 20.36, 20.42, 50.55, 63.50, 65.20, 65.80, 68.20, 69.80, 71.30, 74.30, 74.95, 77.40, 80.10, 85.05, and 90.15 K, respectively.
18	44	E	1925	1500-2500			Pure; density 19.3 g cm^{-3} at room temp; electrical resistivity reported as 5.64, 8.06, 13.54, 19.47, 25.70, 32.02, 38.52, 45.22, 52.08, 59.10, 66.25, 73.55, 81.0, 88.5, 96.2, 103.8, 111.7, and 115.7 μohm cm at 300, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000, 2200, 2400, 2600, 2800, 3000, 3200, 3400, and 3500 K, respectively.
19	272	L	1957	3.4-76		I-38	Pure single crystal; specimen axis in [100] direction; electrical resistivity reported as 0.0123, 0.0141, 0.2155, 0.3551, 0.4297, 0.5087, and 0.5921 μohm cm at 14.50, 20.42, 55.35, 63.95, 68.51, 72.97, and 77.35 K, respectively; heat flow parallel to (±5°) the crystal axis.
20	255	E	1960	2400-3194		1	0.04 Mo, 0.006 O, 0.005 Ti, 0.005 Ni, 0.004 Fe, and 0.027 others; prepared by pressing and sintering metal powder; hot-worked.
21	255	E	1960	2344-3451		2	99.95 W, 0.04 Mo, 0.002 Cu, and 0.008 others; prepared by pressing and sintering metal powder; hot-worked.
22	398	L	1949	15-20			High purity; single crystal; specimen axis in [111] direction; electrical resistivity reported as 0.319, 0.281, 0.236, and 0.187 μohm cm at 14.20, 15.98, 18.05, and 20.48 K, respectively; heat flow at 45 degrees to crystal axis; measured in a field of 10.3 kilooersteds perpendicular to specimen axis.
23	398	L	1949	15-20			As above but measured in a field of 26.39 kilooersteds; electrical resistivity reported as 1.932, 1.810, 1.677, 1.527, 1.382, 1.239, and 1.060 μohm cm at 14.21, 15.07, 15.96, 17.02, 18.06, 19.11, and 20.48 K, respectively.
24	398	L	1949	15-20			As above but measured in a field of 32.65 kilooersteds; electrical resistivity reported as 2.926, 2.737, 2.541, 2.317, 2.099, 1.882, and 1.594 μohm cm at 14.20, 15.07, 15.98, 17.02, 18.04, 19.08, and 20.51 K, respectively.
25	398	L	1949	15-20			As above but measured in a field of 36.27 kilooersteds; electrical resistivity reported as 3.572, 3.347, 3.106, 2.565, and 1.967 μohm cm at 14.21, 15.07, 15.99, 18.05, and 20.45 K, respectively.
26	62	L	1938	15-20			High purity; single crystal; specimen axis parallel to (1,1,1) direction; measured in a transverse magnetic field of 25.85 kilogauss perpendicular to specimen axis.
27	62	L	1938	15-20			The above specimen measured in a transverse magnetic field of 21.83 kilogauss.
28	62	L	1938	15-20			The above specimen measured in a transverse magnetic field of 18.96 kilogauss.

SPECIFICATION TABLE NO. 63 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
29	62	L	1938	15-20			The above specimen measured in a transverse magnetic field of 16.69 kilogauss.
30	62	L	1938	15-20			The above specimen measured in a transverse magnetic field of 13.82 kilogauss.
31	62	L	1938	15-20			The above specimen measured in a transverse magnetic field of 11.44 kilogauss.
32	62	L	1938	15-20			The above specimen measured in a transverse magnetic field of 8.18 kilogauss.
33	62	L	1938	15-20			The above specimen measured in a transverse magnetic field of 5.22 kilogauss.
34	62	L	1938	15-20			The above specimen measured in a transverse magnetic field of 2.61 kilogauss.
35	259	E	1959	1600-2700			Spectrographically pure; 0.010 in. dia; electrical resistivity reported as 46.4, 53.3, 63.3, 71.4, and 83.7 μohm cm at 1622, 1925, 2230, 2471, and 2965 K, respectively.
36	448	L	1937	22-91		W 1	7 cm x 0.106 cm^2; specimen axis at 8 degrees to the [110] direction; measured in a vacuum of 10^{-4}-10^{-6} mm Hg.
37	448	L	1937	21.7		W 1	Measured at H (the transverse magnetic field strength) = 4850 oersteds and θ (the angle between the magnetic field direction and a line perpendicular to the rod axis) = -90° at which H parallel to [111] direction.
38	448	L	1937	27.8		W 1	The above specimen measured at H = 6730 oersteds and θ = -90°.
39	448	L	1937	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = -90°.
40	448	L	1937	21.7		W 1	The above specimen measured at H = 6100 oersteds and θ = -60°.
41	448	L	1937	21.7		W 1	The above specimen measured at H = 6100 oersteds and θ = -50°.
42	448	L	1937	21.7		W 1	The above specimen measured at H = 6100 oersteds and θ = -40°.
43	448	L	1937	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = -20°.
44	448	L	1937	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = 0° at which H perpendicular to [111] direction.
45	448	L	1937	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = +20°.
46	448	L	1937	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = +40°.
47	448	L	1937	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = +60°.
48	448	L	1937	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = +70°.
49	448	L	1937	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = +80°.
50	448	L	1937	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = +90°.
51	448	L	1937	21.7		W 1	The above specimen measured at H = 4850 oersteds and θ = +70°.
52	448	L	1937	21.6		W 1	The above specimen measured at H = 2520 oersteds and θ = +70°.
53	448	L	1937	21.5		W 1	The above specimen with the magnetic field removed.

SPECIFICATION TABLE NO. 63 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
54	436	L	1938	22.2		W 1	Specimen axis in [110] direction; electrical resistivity 0.00463 μohm cm at -252.83 C; measured at H (the transverse magnetic field strength) = 0 and θ (the angle between the magnetic field direction and a line perpendicular to the rod axis) = -56° at which H parallel to [110] direction.
55	436	L	1938	21.7		W 1	The above specimen measured at H = 6100 oersteds and θ = -56°.
56	436	L	1938	21.5		W 1	The above specimen measured at H = 12200 oersteds and θ = -56°.
57	436	L	1938	21.5		W 1	The above specimen measured at H = 0 oersteds and θ = +70° at which H perpendicular to [111] direction.
58	436	L	1938	21.6		W 1	The above specimen measured at H = 2520 oersteds and θ = +70°.
59	436	L	1938	21.7		W 1	The above specimen measured at H = 4850 oersteds and θ = +70°.
60	436	L	1938	21.8		W 1	The above specimen measured at H = 6100 oersteds and θ = +70°.
61	436	L	1938	21.8		W 1	The above specimen measured at H = 12200 oersteds and θ = +70°.
62	436	L	1938	21.0		W 13a	Specimen axis in [100] direction; electrical resistivity 0.01054 μohm cm at -252.82 C; measured at H (the transverse magnetic field strength) = 0 and θ (the angle between the magnetic field direction and a line perpendicular to the rod axis) = -5° at which H nearly parallel to [100] direction.
63	436	L	1938	20.8		W 13a	The above specimen measured at H = 2280 oersteds and θ = -5°; electrical resistivity 0.01980 μohm cm at -252.82 C.
64	436	L	1938	21.0		W 13a	The above specimen measured at H = 4490 oersteds and θ = -5°; electrical resistivity 0.0346 μohm cm at -252.82 C.
65	436	L	1938	21.4		W 13a	The above specimen measured at H = 8750 oersteds and θ = -5°; electrical resistivity 0.0760 μohm cm at -252.82 C.
66	436	L	1938	21.0		W 13a	The above specimen measured at H = 10880 oersteds and θ = -5°; electrical resistivity 0.1044 μohm cm at -252.82 C.
67	436	L	1938	21.0		W 13a	The above specimen measured at H = 11080 oersteds and θ = -5°.
68	436	L	1938	21.1		W 13a	The above specimen measured at H = 12200 oersteds and θ = -5°.
69	436	L	1938	21.0		W 13a	The above specimen measured at H = 0 oersteds and θ = -50° at which H parallel to [110] direction.
70	436	L	1938	20.8		W 13a	The above specimen measured at H = 2280 oersteds and θ = -50°.
71	436	L	1938	21.0		W 13a	The above specimen measured at H = 4490 oersteds and θ = -50°.
72	436	L	1938	21.1		W 13a	The above specimen measured at H = 8750 oersteds and θ = -50°.
73	436	L	1938	21.0		W 13a	The above specimen measured at H = 10880 oersteds and θ = -50°.
74	436	L	1938	21.1		W 13a	The above specimen measured at H = 12200 oersteds and θ = -50°.

SPECIFICATION TABLE NO. 63 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
75	449	L	1917	274.2			0.1 mm dia; tempered for 20 hrs at 225 C; electrical resistivity 0.204 μohm cm at 1 C; Lorenz function $2.88 \times 10^{-8}\ V^2\ K^{-2}$ at 1 C.
76	602	E	1961	1173-2473	< 6		Spectrally pure; two 2.2 mm dia wires used as the test materials; shaped and preliminarily annealed in a high vacuum at 1700 C for 1 hr; electrical resistivity reported as 29.8, 33.1, 38.4, 45.3, 52.0, 59.5, 67.3, and 76.7 μohm cm at 900, 1000, 1200, 1400, 1600, 1800, 2000, and 2200 C, respectively; measured in a high vacuum.
77	579	L	1936	16-22			No details reported.
78	603	R	1962	559-860	2-4	C-54	0.003 Fe, 0.0026 Si, 0.0020 O, 0.0010 S, 0.0010 P and Ni, Cu, H and N; specimen 0.75 in. O.D., 0.25 in. I.D., and 0.75 in. long; arc-cast; maximum exposure temp 2255 C; density 18.87 g cm^{-3} (98.4% of theoretical).
79	603	R	1962	484-1287	2-4	C-55	The above specimen; 2nd run.
80	603	R	1962	1555-1872	2-4	C-85	Similar to the above specimen.
81	603	R	1962	1571-2939	2-4	C-86	Similar to the above specimen; the specimen melted at temp beyond 2255 C (probably because of the carbon eutectic formation, the carbon might come from furnace vapor).
82	651	E	1925	1800-2800			Pure wire.
83	652	C	1961	323-673		JM 740	Spectrographically standardized tungsten; JM 740 of Johnson Mattney and Co.; about 4 mm in dia and 10 cm in length; electrical resistivity reported as 5.45, 6.1, 7.3, 9.8, 12.45, 15.2, 18.1, 21.4, 24.6, 27.8, 30.9, 34.3, 37.7, 41.4, 45.1, 49.7, and 51.8 μohm cm at 20, 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, and 1450 C, respectively; Armco iron used as comparative material.
84	653	E	1963	645-1660			Single crystal.
85	654	P	1965	1300-2900			99.5 pure; impurities: Fe, Mo and traces of other elements; 1.5 mm thick disc cut from a swaged rod; from General Electric Co. Osram Lamp Works; average grain size (after testing) 46 μ; density 19.3 g cm^{-3}; thermal conductivity values calculated from thermal diffusivity measurements using specific heat data of Kubaschewski, O. and Evans, L. L. (Metallurgical Thermochemistry, Pergamon, 1956).
86	669	L	1964	1283-3223			Short rod; electrical resistivity reported as 33.0, 36.0, 39.0, 42.0, 45.2, 48.6, 52.1, 56.0, 59.4, 63.2, 67.0, 71.0, 74.4, 78.0, 81.6, 85.2, 89.0, 92.6, 96.2, and 103.6 μohm cm at 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, and 3000 C, respectively.
87	656	–	1963	1200-3000			< 0.1% impurities; cylindrical specimen; thermal conductivity values calculated from measured heat flow and specific radiation loss.
88	667	E	1962	1615-2780	±10		Spectrographically pure; 0.10 in. dia; electrical resistivity reported as 40.0, 50.0, 56.6, 66.6, and 80.6 μohm cm at 1545, 1812, 2087, ~~[illegible]~~ 2363, and 2618 K, respectively; measured in a vacuum of $< 10^{-6}$ mm Hg.

SPECIFICATION TABLE NO. 62 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
89	668	E	1964	1900			Foil of 60 μ thick; wire rider of 0.2 mm in dia placed on that part of the foil where temp was constant; circular diaphragms used in optical pyrometer system.
90	668	E	1964	1900			Foil of 60 μ thick; rider dia 0.3 mm, circular diaphragms in system.
91	668	E	1964	1900			Foil of 60 μ thick; rider dia 0.2 mm, slit diaphragms in system.
92	668	E	1964	1900			Wire of 0.2 mm in dia; rider dia 0.2 mm, slit diaphragms in system.
93	688	L	1964	317.2	5	LASL; set No. 1, sample 1	An oxide layer on the surface and < 0.0050 oxide inside the specimen; porous right cylinder prepared from tungsten powder obtained from Powder Metallurgical Group of Los Alamos Scientific Lab; material hydrostatically pressed in a plastic sack with 30,000 psi initial pressure, machined and sintered at 1500 C for 2 hrs in a hydrogen reducing atm; particle size 0.8 micron; 72.3% theo. density; electrical resistivity 10.4 μohm cm at 20 C.
94	688	L	1964	323.2	5	LASL; set No. 1, sample 2	Similar to the above specimen except 72.1% theo. density, and 10.6 μohm cm electrical resistivity at 20 C.
95	686	L	1964	326.2	5	LASL; set No. 1, sample 3	Similar to the above specimen except 1350 C sintering temp, 63.2% theo density, and 13.3 μohm cm electrical resistivity at 20 C.
96	688	L	1964	311.2	5	LASL; set No. 1, sample 6	Similar to the above specimen except 1575 C sintering temp, 78.1% theo. density, and 9.1 μohm cm electrical resistivity at 20 C.
97	688	L	1964	311.2	5	LASL; set No. 1, sample 7	Similar to the above specimen except 1625 C sintering temp, 83.6% theo. density, and 8.2 μohm cm electrical resistivity at 20 C.
98	688	L	1964	308.2	5	LASL; set No. 1, sample 11	Similar to the above specimen except sintered at 1700 C for 9 hrs, 95.3% theo. density, 6.2 μohm cm electrical resistivity at 20 C, and the ratio of isolated pores to total pores ≈0.9.
99	688	L	1964	320.2	5	LASL; set No. 1 sample 12	Similar to the above specimen except 95.5% theo. density, and 6.3 μohm cm electrical resistivity at 20 C.
100	688	L	1964	319.2	5	LASL; set No. II, sample 2	Similar to the above specimen except sintered at 1700 C for 3 hrs, particle size 2–4.5 microns, 74.4% theo. density, and 10.5 μohm cm electrical resistivity at 20 C.
101	775	–	1966	1930–2933	~15	S 1	99.8⁺ pure; cylindrical specimen 1.52 in. in dia, 0.502 in. thick; polished; thermal conductivity determined by equating the axial heat flux within the specimen to the radiation flux at the center of the top surface.
102	775	–	1966	2005–2983	~15	S 2	Similar to above except dimensions 1.006 in. dia, 0.504 in. thick.
103	775	–	1966	2138–2978	~15	S 3	Similar to above except dimensions 1.0066 in. dia, 0.356 in. thick.
104	775	–	1966	2086–3075	~15	S 4	Similar to above except dimensions 0.804 in. dia, 0.284 in. thick.
105	775	–	1966	1506–2150	~15	P 1	Unknown purity; cylindrical specimen; 1.52 in. dia, 0.538 in. thick; fabricated by gravity sintering tungsten particles 0.006 to 0.01 in. in size; fired for a long duration at > 2478 K; porosity 55%; thermal conductivity data determined by the same method as above.

SPECIFICATION TABLE NO. 63 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
106	775	-	1966	1384-2569	~15	P 2	Similar to above except dimensions 1.45 in. dia, 0.507 in. thick, and 45% porosity.
107	775	-	1966	1366-2894	~15	P 3	Similar to above except dimensions 0.975 in. dia, 0.379 in. thick, and 46% porosity.
108	775	-	1966	1958-2366	~15	P 4	Similar to above except dimensions 1.03 in. dia, 0.302 in. thick, and 42% porosity.
109	775	-	1966	1755-2753	~15	P 5	Similar to above except dimensions 0.80 in. dia, 0.25 in. thick, and 42% porosity.
110	709	E	1962	1173-2473			1 mm in dia, 30 mm long; electrical resistivity reported as 0.295, 0.23, 0.258, and 0.293 μohm cm at 1000, 1400, 1800, and 2200 C, respectively.
111	905, 906	E	1965	1618-2081		Sample No. 1	Foil strip; 2 mm x 60 μ x 20 mm.
112	905, 906	E	1965	1490-1779		Sample No. 2	Foil strip; 3 mm x 60 μ x 20 mm.
113	905, 906	E	1965	1979-2999		Sample No. 3	Specimen 0.3 mm in dia and 20 mm long.
114	905, 906	E	1965	1963-2384		Sample No. 4	Specimen 0.2 mm in dia and 20 mm long.
115	841	L	1967	313-664		I	99.99 W, 0.01 Mo, trace Si and Cu; 0.4 cm dia x 10 cm long; supplied by Johnson Matthey Co.; measured in the intermediate-temp apparatus.
116	841	C	1967	451-751		I	The above specimen measured in the high-temp apparatus; Armco iron used as comparative material.
117	841	C	1967	405-992		II	Similar to above.
118	907, 908	P	1966	1000-2000			99.95 W and 0.035 Mo; forged rod specimen 10 mm in dia and 80 mm long; density 19.17 g cm^{-3}; thermal conductivity values calculated from measured data of thermal diffusivity using specific heat data taken from Hoch, M. and Johnston, H. L. (J. Phys. Chem., 65, 855, 1961).
119	909	C	1966	285-500	± 5	1	0.026 O, 0.010 Mo, < 0.005 Si, 0.001 each of Cu and Ag, < 0.001 each of Al, Ca, Fe, Mg, Mn, and Ni, and < 0.0005 N; tungsten sheets of ~0.060 in. thick supplied by Fansteel Metallurgical Corp; specimen dimensions 1.000 in. dia x 1.250 in. long; squares cut from the sheets clamped together to form cubes, single welds perpendicular to the sheets made at opposite ends with an inert-gas arc welder, machined to size with the sheets parallel to the cylinder axis; thermocouple holes drilled at 75 degrees to the sheets; density 19.21 g cm^{-3} at 26.3 C; Armco iron used as comparative material; measured in a helium atm with diatomaceous insulation.
120	909	C	1966	549-972	± 5	1	Second run of the above specimen with thermatomic carbon insulation.
121	909	C	1966	823-1042	± 5	1	Same as above, third run.
122	909	R	1966	1266-1997	± 7	2	Prepared from the same material as the above specimen; consisted of 32 one-inch dia discs with 0.25 in. holes in their centers, the central 16 discs used as test specimen.
123	909	R	1966	1451-2033	± 7	2	Second run of the above specimen.

SPECIFICATION TABLE NO. 63 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
124	849	–	1966	1513-1930		No. 1	0.0007 C, < 0.0005 each of N and O, and < 0.00005 H; specimen 2.5339 cm in dia and 0.27 cm long; density 18.89 g cm^{-3}; thermal conductivity derived from the temp distribution on the flat surface of the cylindrical disc specimen heated in high vacuum (10^{-5} mm Hg) by high frequency induction.
125	849	–	1966	1572-1905		No. 2	Similar to the above specimen except specimen 2.4785 cm in dia and 0.2714 cm thick with density 19.03 g cm^{-3}.
126	849	–	1966	1836-2608		No. 3	Similar to the above specimen except specimen 2.0801 cm in dia and 0.27 cm thick with avg grain size 0.035 mm dia and density 19.23 g cm^{-3}.
127	996	L	1967	87-377			Spectroscopically standardized; 4 mm dia x 10 cm long; supplied by Johnson Matthey Co.; electrical resistivity reported as 0.24, 0.83, 1.08, 3.32, 5.61, and 733 μohm cm at 5, 78, 91, 195, 298, and 374 K, respectively. (Tabulated data received from author.)

DATA TABLE NO. 63 THERMAL CONDUCTIVITY OF TUNGSTEN

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watts cm^{-1}K^{-1}]

CURVE 1

T	k
1.82	1.515
2.34	1.990
2.86	2.525
3.38	2.929
4.16	3.687
5.97	5.065
7.80	6.212
9.22	7.475
10.40	8.939
12.21	9.710
15.58	10.960
16.88	11.818
18.96	12.121
21.04	11.970
23.38	11.364
26.75	10.455
29.87	9.141
33.77	7.677
38.44	5.934
55.32	3.182
63.64	2.879
77.90	2.525
90.90	2.405
103.10	2.350
118.70	2.172

CURVE 2

T	k
21.2	34.300
83.2	2.320

CURVE 3

T	k
21.2	1.800
[illegible]3.2	1.830

CURVE 4

T	k
15.5	23.810
17.1	22.730
18.6	20.410
21.[illegible]	[illegible]

CURVE 5

T	k
290	1.992
373	1.975

CURVE 6

T	k
77.4	1.860
90.2	1.820
273.2	1.700
372.8	1.730

CURVE 7

T	k
77.36	1.930
90.2	1.870
273.2	1.690
373.1	1.680

CURVE 8

T	k
73	2.260
194	1.600
273	1.380

CURVE 9

T	k
240	1.729
250	1.708*
260	1.688
270	1.669*
273	1.663*
280	1.651
290	1.633*
298	1.620*
300	1.617*
310	1.601
350	1.544
400	1.483
450	1.432
500	1.387
550	1.348
600	1.313

CURVE 10*

T	k
275.93	1.640
277.32	1.646
278.02	1.635
280.23	1.647

CURVE 11*

T	k
276.35	1.655
277.03	1.652
278.97	1.648
282.72	1.639
286.05	1.640

CURVE 12

T	k
1500	0.980
1700	1.080
1900	1.180
2100	1.280
2300	1.380
2500	1.480

CURVE 13

T	k
2.80	0.462
3.57	0.642
4.95	0.832
6.50	1.120
7.91	1.354
9.90	1.707
12.53	2.120
15.50	2.630
18.41	2.913
21.71	3.315
24.18	3.480
26.60	3.641
30.00	3.652
32.75	3.658
35.83	3.560
38.90	3.506
41.76	3.342
42.86	3.240

CURVE 14

T	k
1100	1.170
1200	1.153
1300	1.138
1400	1.122
1500	1.106
1600	1.089
1700	1.073
1800	1.058
1900	1.042
2000	1.026

CURVE 15

T	k
90.2	1.929
194.7	1.695
273.2	1.669*
373.2	1.628

CURVE 16

T	k
90.2	[illegible].138
194.7	1.778
273.2	1.695*
373.2	1.632

CURVE 17

T	k
15.33	84.7
15.59	82.0
15.75	81.3
16.68	70.9
16.69	74.6
17.24	68.5
17.27	67.6
17.69	66.2
17.85	65.8
19.03	59.5
19.20	57.8
19.55	57.1
19.87	54.6
20.17	51.9
20.74	50.5
21.58	46.5

CURVE 17(cont.)

T	k
57.29	3.41
57.67	3.38
66.35	2.92
67.88	2.88
70.98	2.78
75.53	2.66
76.14	2.62
83.72	2.48
88.38	2.44

CURVE 18

T	k
1500	0.990
1600	1.020
1700	1.040
1800	1.070
1900	1.090
2000	1.110
2100	1.130
2200	1.150
2300	1.170
2400	1.190
2500	1.210

CURVE 19

T	k
3.38	6.060
3.58	6.580
3.61	6.620
3.84	7.250
4.09	8.000
18.16	22.220
19.14	22.120
19.95	21.930
58.10	3.260
65.77	2.674
67.50	2.620
70.40	2.481
71.20	2.330
74.42	2.364
75.90	2.250

CURVE 20

T	k
2400	1.590
2600	1.464
2888	1.339
3194	1.423

CURVE 21

T	k
2344	1.477
2562	1.590
2888	1.297
3185	1.423
3451	1.251

CURVE 22

T	k
14.84	2.57
15.74	2.91
16.84	3.43
18.43	4.24
19.96	4.57

CURVE 23

T	k
15.16	0.629
15.97	0.704
16.92	0.829
17.95	0.973
18.97	1.14
20.01	1.38

CURVE 24

T	k
14.93	0.438
15.81	0.500
16.21	0.541
16.93	0.620
17.98	0.746
18.94	0.870
19.95	1.04

CURVE 25

T	k
14.94	0.384

CURVE 25(cont.)

T	k
15.85	0.432
18.05	0.633
19.82	0.857

CURVE 26*

T	k
15.13	0.638
16.05	0.709
16.91	0.822
18.01	1.00
19.06	1.22
19.95	1.37

CURVE 27

T	k
15.03	0.834
15.96	0.945
16.12	0.968
17.06	1.12
18.12	1.34
19.03	1.57
19.98	1.81

CURVE 28

T	k
15.17	1.03
16.04	1.16
16.98	1.35
17.99	1.57
18.97	1.83
19.91	2.16

CURVE 29

T	k
15.08	1.27
15.28	1.31
16.11	1.47
16.91	1.66
18.02	1.97
18.94	2.27
19.90	2.58

CURVE 30

T	k
15.16	1.65
18.04	2.51
18.97	3.04
19.92	3.39

CURVE 31

T	k
15.12	2.36
15.92	2.60
16.91	2.97
17.85	3.37
18.93	3.97
19.80	4.35

CURVE 32

T	k
15.06	3.97
15.87	4.33
16.72	4.83
17.80	5.52
18.90	6.33
19.82	6.90

CURVE 33

T	k
15.01	7.87
15.80	8.47
16.67	9.26
17.76	10.20
18.93	11.64
19.83	12.22

CURVE 34

T	k
15.25	18.02
15.75	18.59
17.07	21.32
18.08	22.08
19.18	23.20
20.17	23.64

* Not shown in figure.

DATA TABLE NO. 63 (continued)

T	k
CURVE 35	
1600	1.19
1700	1.22
1800	1.24
1900	1.25
2000	1.27
2100	1.30
2200	1.30
2300	1.31
2400	1.37
2500	1.39
2600	1.39
2700	1.41
CURVE 36	
21.5	36.7
79.0	2.31
79.7	2.32
91.2	2.14
CURVE 37	
21.7	11.9
CURVE 38*	
21.52	8.7
CURVE 39	
21.79	9.4
CURVE 40*	
21.74	10.4
CURVE 41*	
21.72	10.3
CURVE 42	
21.74	9.7
CURVE 43	
21.76	9.21
CURVE 44	
21.80	8.8
CURVE 45*	
21.73	9.06
CURVE 46*	
21.75	9.2
CURVE 47*	
21.78	8.3
CURVE 48*	
21.79	8.2
CURVE 49*	
21.76	8.7
CURVE 50*	
21.75	9.16
CURVE 51	
21.71	9.95
CURVE 52	
21.55	16.6
CURVE 53*	
21.5	36.7
CURVE 54*	
21.5	36.7
CURVE 55	
21.72	10.5
CURVE 56	
21.54	5.27
CURVE 57*	
21.50	36.7
CURVE 58*	
21.55	16.6
CURVE 59*	
21.71	10.0
CURVE 60	
21.79	8.2
CURVE 61	
21.78	3.91
CURVE 62	
21.02	22.2
CURVE 63	
20.84	16.3
CURVE 64	
20.99	11.3
CURVE 65	
21.36	6.69
CURVE 66	
21.01	5.14
CURVE 67	
20.97	5.02
CURVE 68	
21.06	4.53
CURVE 69*	
21.02	22.2
CURVE 70*	
20.80	16.4
CURVE 71*	
20.97	11.2
CURVE 72	
21.14	6.30
CURVE 73	
21.02	4.67
CURVE 74	
21.13	4.06
CURVE 75	
274.2	1.60
CURVE 76	
1173.2	1.15*
1273.2	1.11
1373.2	1.07
1773.2	0.996
1873.2	0.979
1973.2	0.962
2073.2	0.954
2173.2	0.941
2273.2	0.929
CURVE 76 (cont.)	
2373.2	0.912
2473.2	0.904
CURVE 77	
15.5	23.8*
17.1	22.7*
18.6	20.4*
21.8	18.1*
CURVE 78	
559.3	0.507
717.1	0.470
842.6	0.507
847.6	0.529*
851.0	0.519*
851.0	0.441
859.3	0.496*
860.4	0.490
CURVE 79	
483.7	0.669
753.2	0.616*
754.8	0.622*
763.7	0.591
984.8	0.482
990.4	0.505
990.9	0.518
1185.9	0.438
1192.1	0.551
1196.5	0.427
1285.4	0.511
1287.1	0.635
CURVE 80	
1555.4	0.858
1555.4	0.637
1558.2	0.725
1866.5	0.573
1869.3	0.682
1872.1	0.712
CURVE 81	
1571.0	0.663
1844.3	0.711
1844.3	0.656
2263.7	0.538*
2263.7	0.541*
2263.7	0.493
2263.7	0.470
2266.5	0.519*
2272.1	0.526*
2516.7	0.571*
2519.3	0.570*
2533.2	0.599
2536.0	0.554
2761.0	0.815
2761.0	0.782
2938.7	0.837
CURVE 82	
1800	1.22*
1900	1.26*
2000	1.29
2100	1.31
2200	1.33
2300	1.35*
2400	1.37*
2500	1.39*
2600	1.41*
2700	1.42*
2800	1.43
CURVE 83	
323.2	1.78*
373.2	1.68*
473.2	1.52
573.2	1.38
673.2	1.32
CURVE 84	
645	1.25
820	1.22
925	1.10
1020	1.16
CURVE 84 (cont.)	
1075	1.26
1120	1.08
1200	1.13
1240	1.18
1275	1.16
1400	1.06*
1500	1.05*
1660	1.00*
CURVE 85	
1300	1.10*
1800	1.02
2200	0.98
2600	0.959
2900	0.957
CURVE 86	
1283.2	1.000
1293.2	0.900
1358.2	1.000
1373.2	0.950
1388.2	1.000*
1408.2	1.000*
1428.2	0.950
1458.2	0.940*
1473.2	0.975*
1498.2	0.975*
1528.2	0.925
1548.2	0.950*
1563.2	1.000*
1598.2	0.925
1683.2	0.925
1703.2	0.975
1723.2	0.950*
1723.2	1.100*
1728.2	0.925
1788.2	0.975
1843.2	0.950
1933.2	0.900*
1943.2	0.925
2003.2	0.950
2138.2	0.950
2218.2	0.900
CURVE 86 (cont.)	
2283.2	0.900
2303.2	1.000*
2363.2	0.985*
2563.2	0.925*
2658.2	0.950*
2713.2	0.875
2768.2	0.925
2788.2	1.000*
2833.2	0.950*
2978.2	0.925
3082.2	0.875
3148.2	0.925
3178.2	0.900
3183.2	0.825
3223.2	0.975
3223.2	0.875
CURVE 87	
1200	1.12*
1400	1.10*
1600	1.08*
1800	1.06*
2000	1.035*
2200	1.015
2400	0.99
2600	0.97
2800	0.96
3000	0.935
CURVE 88	
1615	0.837
1700	0.858
1835	0.761
1955	0.732
2000	0.761
2065	0.753
2135	0.774
2210	0.732
2655	0.837
2725	0.669
2780	0.690

*Not shown on plot

DATA TABLE NO. 63 (continued)

T	k
CURVE 89*	
1900	1.21
CURVE 90*	
1900	1.17
CURVE 91*	
1900	1.18
CURVE 92	
1900	1.10
CURVE 93	
317.2	1.046
CURVE 94	
323.2	1.046
CURVE 95	
326.2	0.795
CURVE 96	
311.2	1.172
CURVE 97	
311.2	1.297
CURVE 98	
308.2	1.590
CURVE 99	
320.2	1.590
CURVE 100	
319.2	0.962

T	k
CURVE 101*	
1930.4	1.191
2050.9	1.142
2191.5	1.203
2294.3	1.186
2447.1	1.056
2652.6	1.056
2824.8	1.054
2933.2	1.018
CURVE 102*	
2005.4	1.454
2213.7	1.142
2424.3	1.194
2644.3	1.160
2983.2	1.315
CURVE 103*	
2138.7	1.246
2144.3	1.246
2208.2	1.333
2235.9	1.220
2355.3	1.211
2441.5	1.186
2447.1	1.317
2555.4	1.385
2583.2	1.056
2655.4	1.385
2705.4	1.038
2772.1	1.419
2813.7	0.969
2863.7	1.411
2919.3	1.186
2977.6	0.980
CURVE 104*	
2085.9	1.211
2097.1	1.237
2163.7	1.211
2178.7	1.333
2305.4	1.116
2322.1	1.428
2360.9	1.523

T	k
CURVE 104 (cont.)*	
2427.6	0.969
2452.6	1.099
2497.1	1.194
2566.5	1.237
2677.6	1.350
2744.3	1.263
2774.8	1.099
2841.5	1.324
2883.2	0.938
3022.1	1.064
3074.8	1.038
CURVE 105*	
1505.9	0.0857
1710.9	0.0815
1991.5	0.0848
2149.8	0.1099
CURVE 106	
1384.3	0.148
1397.1	0.161
1413.2	0.157
1505.4	0.153
1552.6	0.144
1566.5	0.145*
1588.7	0.145*
1702.6	0.137
1869.3	0.145
1902.6	0.136
2058.2	0.148
2191.5	0.142
2334.8	0.124
2510.9	0.131
2647.1	0.138*
2569.4	0.133*
CURVE 107	
1366.5	0.179
1602.6	0.156
1835.9	0.166
2047.1	0.165
2285.9	0.158

T	k
CURVE 107 (cont.)	
2488.7	0.166
2669.3	0.177
2894.3	0.185
CURVE 108	
1958.2	0.173
2041.5	0.170
2149.8	0.173
2227.6	0.168
2284.3	0.185
2366.5	0.185
CURVE 109	
1755.4	0.182
1855.4	0.163
1874.8	0.170
1877.6	0.186
1966.5	0.192
1966.5	0.200
2030.4	0.235
2045.4	0.183
2102.6	0.187
2158.2	0.187
2181.5	0.202
2205.4	0.183
2233.2	0.198
2285.9	0.188
2310.9	0.208
2374.8	0.186
2391.5	0.230
2472.1	0.216
2477.6	0.208
2477.6	0.182
2557.1	0.177
2558.2	0.196
2635.9	0.196
2672.1	0.181
2752.6	0.205
CURVE 110*	
1173.2	1.151
1198.2	1.140

T	k
CURVE 110 (cont.)*	
1218.2	1.125
1248.2	1.118
1287.2	1.100
1338.2	1.088
1348.2	1.079
1383.2	1.067
1423.2	1.061
1473.2	1.048
1493.2	1.040
1523.2	1.036
1573.2	1.019
1623.2	1.019
1653.2	1.010
1693.2	1.004
1713.2	1.004
1758.2	0.992
1783.2	0.990
1873.2	0.975
1933.2	0.969
2018.2	0.956
2078.2	0.952
2113.2	0.943
2193.2	0.937
2268.2	0.929
2348.2	0.923
2403.2	0.914
2473.2	0.908
CURVE 111*	
1618	1.159
1691	1.219
1691	1.310
1749	1.224
1863	1.224
1946	1.202
1964	1.154
2081	1.199
CURVE 112	
1499	1.239
1549	1.343
1650	1.220
1779	1.161

T	k
CURVE 113*	
1979	1.205
2060	1.116
2107	1.154
2217	1.072
2263	1.129
2367	1.055
2471	1.035
2617	1.085
2708	1.061
2777	0.975
2806	0.933
2836	0.976
2999	0.999
CURVE 114*	
1963	1.113
2084	1.143
2384	1.124
CURVE 115	
313.2	1.799
314.2	1.786*
329.2	1.767
337.2	1.678*
343.2	1.714*
393.2	1.643
468.2	1.498
484.2	1.547
515.2	1.466
543.2	1.423
592.2	1.353*
600.2	1.352
664.2	1.286
CURVE 116*	
451.2	1.507
583.2	1.364
658.2	1.275
664.2	1.299
751.2	1.240

T	k
CURVE 117	
405.2	1.657
414.2	1.587
438.2	1.600
494.2	1.531*
497.2	1.508*
511.2	1.489*
720.2	1.305
877.2	1.208
989.2	1.161
992.2	1.185
CURVE 118	
1000	1.31
1150	1.25
1249	1.22
1375	1.19
1500	1.17
1750	1.14
2000	1.10*
CURVE 119*	
285.1	1.867
284.1	1.83
293.7	1.831
373.7	1.67
384.8	1.627
397.0	1.627
457.0	1.520
499.8	1.496
CURVE 120	
548.7	1.475
711.5	1.383
762.6	1.389
943.7	1.292
971.5	1.314
CURVE 121*	
823.7	1.230
1042.0	1.083

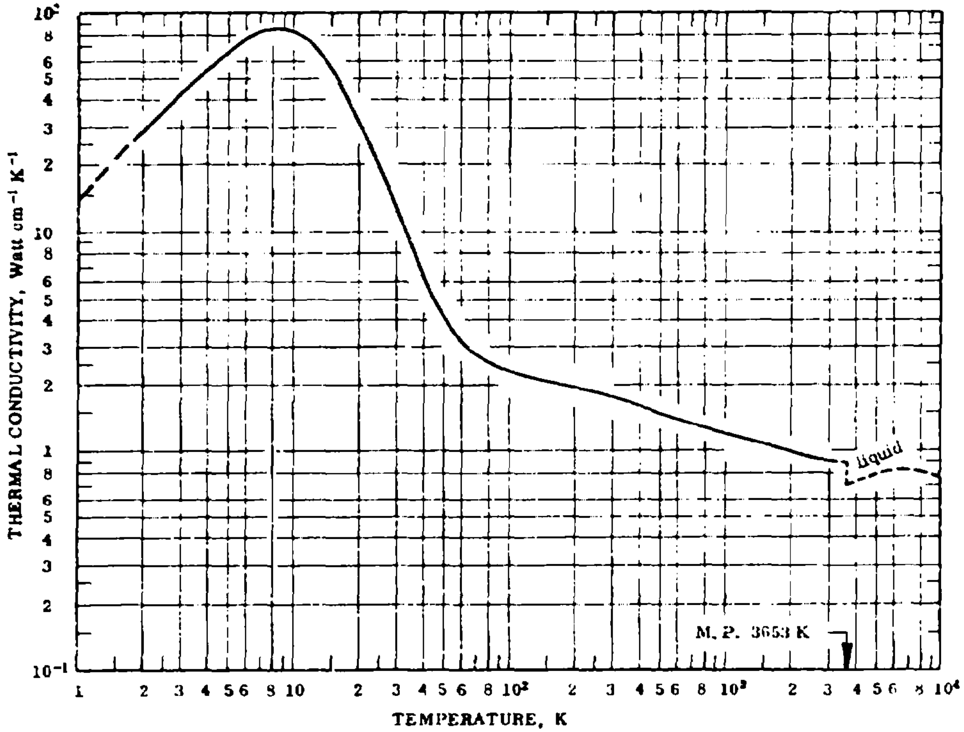
*Not shown on plot

DATA TABLE NO. 63 (continued)

T	k	T	k
CURVE 122*		CURVE 126*	
1266	1.10	1836	0.950
1264	1.116	1946	0.946
1264	1.070	2206	0.911
1267	1.089	2350	0.902
1613	1.096	2463	0.866
1615	1.002	2608	0.905
1678	0.997		
1691	1.007	CURVE 127*	
1947	1.024		
1947	1.005	87.3	2.003
1997	0.986	95.7	1.952
1997	0.995	99.6	1.927
		199.5	1.733
CURVE 123*		201.7	1.729
1451	1.096	204.3	1.727
1452	1.093	278.2	1.660
1453	1.112	281.5	1.659
1454	1.086	334.7	1.603
2005	0.982	337.8	1.606
2005	1.028	373.8	1.556
2005	0.975	377.3	1.556
2005	0.979		
2033	1.002		
2033	0.997		
2033	0.991		
CURVE 124*			
1513	1.183		
1536	1.197		
1578	1.169		
1673	1.072		
1748	1.122		
1835	1.088		
1898	1.092		
1930	1.008		
CURVE 125*			
1571.5	1.182		
1640	1.144		
1675	1.084		
1719.5	1.055		
1745.5	1.036		
1835.5	1.048		
1905	1.017		

*Not shown on plot

FIGURE AND TABLE NO. 63R RECOMMENDED THERMAL CONDUCTIVITY OF TUNGSTEN



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(14.4)‡	(832)	-457.9
2	28.7	1660	-456.1
3	42.6	2460	-454.3
4	55.6	3210	-452.5
5	67.1	3880	-450.7
6	76.2	4400	-448.9
7	82.4	4760	-447.1
8	85.3	4930	-445.3
9	85.1	4920	-443.5
10	82.4	4760	-441.7
12	72.4	4180	-438.1
14	60.4	3490	-434.5
16	49.3	2850	-430.9
18	40.0	2310	-427.3
20	32.6	1880	-423.7
25	20.4	1180	-414.7
30	13.1	757	-405.7
35	8.9	514	-396.7
40	6.5	376	-387.7
50	4.17	241	-369.7
60	3.18	184	-351.7
70	2.76	159	-333.7
80	2.56	148	-315.7
90	2.44	141	-297.7
100	2.35	136	-279.7
150	2.10	121	-189.7
200	1.97	114	- 99.7
250	1.86	107	- 9.7
273.2	1.82	105	32.0
300	1.78	103	80.3
350	1.70	98.2	170.3
400	1.62	93.6	260.3
500	1.49	86.1	440.3
600	1.39	80.3	620.3
700	1.33	76.8	800.3
800	1.28	74.0	980.3
900	1.24	71.7	1160

T_1	k_1	k_2	T_2
1000	1.21	69.9	1340
1200	1.15	66.4	1700
1400	1.11	64.1	2060
1600	1.07	61.8	2420
1800	1.03	59.5	2780
2000	1.00	57.8	3140
2200	0.977	56.5	3500
2400	0.957	55.3	3860
2600	0.938	54.2	4220
2800	0.924	53.4	4580
3000	0.913	52.8	4940
3500	(0.898)	(51.9)	5840
3653	(0.895)	(51.7)	6115
	In Liquid State		
3653	(0.705)	(40.7)	6115
4000	(0.730)	(42.2)	6740
4500	(0.761)	(44.0)	7640
5000	(0.785)	(45.4)	8540
6000	(0.811)	(46.9)	10340
7000	(0.819)	(47.3)	12140
8000	(0.816)	(47.1)	13940
9000	(0.799)	(46.2)	15740
10000	(0.768)	(44.4)	17540
11000	(0.732)	(42.3)	19340
12000	(0.694)	(40.1)	21140
13000	(0.646)	(37.3)	22940
14000	(0.594)	(34.3)	24740
15000	(0.538)	(31.1)	26540
16000	(0.478)	(27.6)	28340
17000	(0.416)	(24.0)	30140
18000	(0.352)	(20.3)	31940
19000	(0.286)	(16.5)	33740
20000	(0.217)	(12.5)	35540
21000	(0.146)	(8.44)	37340
22000	(0.0736)	(4.25)	39140
23000	(~0)	(~0)	40940

REMARKS

The recommended values are for well-annealed 99.99⁺% pure tungsten with residual electrical resistivity ρ_0 = 0.00170 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.40, α' = 2.06 x 10^{-5}, and β = 0.0696. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature, and 3 to 5% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or estimated.

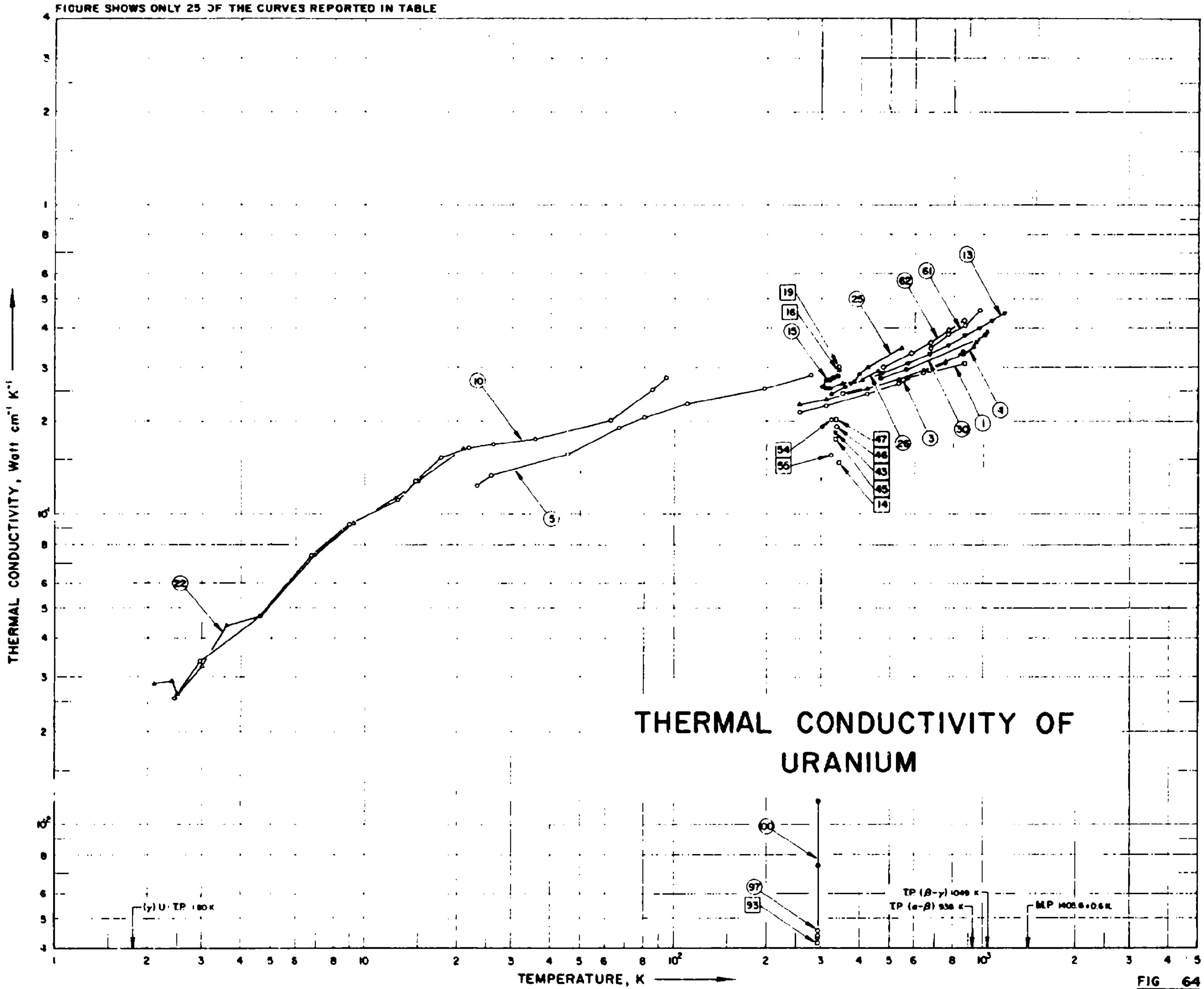


FIGURE SHOWS ONLY 25 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF URANIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
(γ) U · T.P. 180 K
T.P. (β-γ) 1049 K
T.P. (α-β) 938 K
M.P. 1405.6±0.6 K

FIG 64

SPECIFICATION TABLE NO. 64 THERMAL CONDUCTIVITY OF URANIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 64]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	46		1958	353, 873			Mg-reduced.
2	46		1958	423, 873			Ca-reduced.
3	32	R	1954	255-867			Pure; cylindrical disc specimen; rolled in the α-phase; as received; data taken from smoothed curve.
4	32	R	1954	255-1033			Pure; cylindrical disc specimen; rolled in the α-phase; heated to 750 C for 10 min in the β-phase, then water quenched; data taken from smoothed curve.
5	139	L	1952	23-278	±5.0		Approx 99.8 pure; specimen in a rod form 0.5 in. in dia and 2.5 in. long; heated at 700 C in a lead bath for 10 min then quenched in water at 50 C; electrical resistivity reported as 4.07, 9.79, 10.4, 9.96, 9.72, 13.3, 13.4, 13.2, 21.6, 21.6, and 28.4 μohm cm at 21.14, 77.60, 77.61, 77.61, 77.61, 109.7, 109.7, 109.7, 194.5, 194.5, and 277.2 K, respectively; $\rho(293K)/\rho(20K) = 10.6$.
6	29	C	1952	313, 373		695	Pure; 1.445 in. dia x 2.008 in. long; supplied by Sylvania Electric Products Corp; prepared by hot-pressing uranium powder; density 18.86 g cm^{-3}; Armco iron used as comparative material.
7	29	C	1952	313, 373		BMI	Pure; rolled from 1.625 in. to 0.875 in. in dia at 500 C, heat treated at 725 C for 0.5 hr, water quenched from 725 C, and α-phase annealed at 525 C for 1 hr; density 18.86 g cm^{-3}; Armco iron used as comparative material.
8	29	C	1952	313, 373		688	Pure; 1.449 in. dia x 1.98 in. long; supplied by Sylvania Electric Products Corp; powder-compact prepared by decomposition of UH_3 under hot pressing; grain size 0.25-0.50 mm in dia; density 18.84 g cm^{-3}; Armco iron used as comparative material.
9	29	C	1952	313, 373		690	Pure; 1.445 in. dia x 2.06 in. long; supplied by Sylvania Electric Products Corp; powder-compact specimen prepared by decomposition of UH_3 under hot pressing; fine grained; density 18.905 g cm^{-3}; Armco iron used as comparative material.
10	122	L	1955	2.5-94	±3.0		Highly pure; specimen 2.95 cm long and 0.203 cm in dia; supplied by Atomic Energy Research Establishment; electrical resistivity reported as 2.2, 2.4, 2.5, 2.7, 3.0, 4.2, 6.7, 9.4, and 11.1 μohm cm at 9.4, 13.5, 17.8, 20.6, 26.1, 35.1, 56.3, 79.5, and 90.0 K, respectively.
11	86	C	1945	407-534		U1	0.068 C, 0.004 Si, 0.0035 Fe, 0.002 Ni, 0.0009 N, 0.0002 Cr, 0.0002 Ag, and 0.00014 B; 1 in. dia x 10.75 in. long; extruded; thermal conductivity measured in the direction of extrusion; brass used as comparative material.
12	86	C	1945	340-711		U2	0.0720 C, 0.0150 Fe, 0.0100 Ag, 0.0028 N, 0.0020 Ni, 0.00175 Si, 0.0005 Cu, 0.0003 Cr, and 0.00012 B; 1 in. dia x 10.75 in. long; extruded; thermal conductivity measured in the direction of extrusion; brass used as comparative material.

SPECIFICATION TABLE NO. 64 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
13	33	E	1955	371-1105	±5.0		Pure; 0.86 cm dia x 14 cm long; density 18.6 g cm^{-3}; electrical resistivity reported as 39.6, 41.6, 41.8, 43.4, 43.9, 45.4, 46.3, 47.2, 48.8, 50.9, 51.2, 52.4, 54.1, 56.5, 56.1, 57.8, 58.2, 56.9, 57.8, 58.4, 57.9, 59.5, 59.3, 58.9, 57.7, 58.5, 56.0, 50.5, 50.4, 54.3, and 54.3 μohm cm at 97, 137, 137, 185, 188, 192, 234, 236, 277, 316, 323, 353, 366, 432, 440, 458, 463, 466, 475, 532, 532, 597, 623, 640, 645, 652, 696, 711, 720, 829, and 835 C, respectively; thermal conductivity data show no discontinuous change at the transition points, whereas the electrical resistivity data show sudden changes.
14	276	C	1953	343	3.0		Pure; specimen 0.1875 x 0.1875 x 1.75 in.; density 18.8 g cm^{-3}; Armco iron used as comparative material.
15	245	L	1945	304-339	2.0	C-241-7B	From an "as rolled" rod, heated 2 hrs at 850 C and water quenched.
16	394	C	1955	343.2	±3.0	1 B 2	0.03 C; supplied by Argonne National Laboratory; as-rolled; Armco iron used as comparative material.
17	394	C	1955	343.2	±3.0	2 B 3	0.08 C; supplied by Argonne National Laboratory; as-rolled; Armco iron used as comparative material.
18	394	C	1955	343.2	±3.0	A-6	High purity; supplied by Argonne National Laboratory; quenched from 1000 C; Armco iron used as comparative material.
19	394	C	1955	343.2	±3.0	A-8	High purity; supplied by Argonne National Laboratory; quenched from 900 C; Armco iron used as comparative material.
20	394	C	1955	343.2	±3.0	35	Supplied by Argonne National Laboratory; prepared from hot-pressed UH_3; Armco iron used as comparative material.
21	394	C	1955	343.2	±3.0	5 A 3	0.1 Cr; supplied by Argonne National Laboratory; as-rolled; Armco iron used as comparative material.
22	97	L	1952	2.1-21	2.0-3.0	U 1	Supplied by Atomic Energy Research Establishment.
23	414	L	1954	373-923	±2.0	U 1	Bar specimen; cast.
24	414	L	1954	373-923	±2.0	U 2	The above specimen heated to 690 C, maintained for several hrs in the β-phase then cooled to room temp at a rate of 4.2 C per min to change from β to α phase.
25	415	E	1953	311-548	±5.0		Cylindrical bar specimen; cast.
26	415	E	1953	323-458	±5.0		Cylindrical bar specimen; cast; irradiated to 190 M.W.D./Tonne at 300 C; "cooling time" >1 yr.
27	395	C	1958	293-1073	< ±5.0		Measured in vacuum; Zircaloy-2 was used as comparative material.
28	416	L	1949	293-473		Canadian extruded No. 1	0.026 Si, 0.0188 Fe, 0.0036 Ni, 0.0030 Mn, 0.001 Cu, 0.0009 Cr, 0.0001 Co, and 0.00005 Ag; specimen approx 2.5 cm in dia and 8.0 cm in length; taken from a bar of metal refined in Canada, extruded in the γ-phase at 800 C to 900 C by Bureau of Mines; heated at 250 C for an hr for tinning; measured in vacuum.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
29	416	L	1949	291-422		Canadian extruded No. 1	The above specimen measured in a hotter furnace with different temp gradient in guard sleeve.
30	416	L	1949	470-1003		Canadian extruded No. 1	The above specimen heated at 800 C for 0.5 hr before measurement.
31	416	L	1949	420, 667		Canadian extruded No. 1	The above specimen heated to 400 C three times before measurement.
32	416	L	1949	470, 572		Canadian extruded No. 1	The above specimen heated to 500 C; measured by a new main heater.
33	416	L	1949	573.9		Canadian extruded No. 1	The above specimen heated to 400 C for 40 min prior to measurement.
34	416	L	1949	574-872		Canadian extruded No. 1	The above specimen tempered for 6 hrs at 600 C during the measurement.
35	416	L	1949	304-878		Canadian extruded No. 1	The above specimen completely remounted and heated to 600 C to set bonds.
36	416	L	1949	477-877		Canadian extruded No. 1	The above specimen heated to 600 C for 3 hrs and cooled down before measurement.
37	416	L	1949	299-878		Canadian extruded No. 1	The above specimen heated for 1.5 hrs at 700 C.
38	416	L	1949	477-878		Canadian extruded No. 1	The above specimen heated for 2 hrs at 700 C.
39	416	L	1949	475-878		Canadian extruded No. 1	The above specimen heated for 2.5 hrs at 600 C.
40	417, 701	C	1943	323-573			Natural uranium; 1 in. in dia; extruded; measured along the direction of extrusion; brass used as comparative material (assumed thermal conductivity 0.23 cal sec^{-1} cm^{-1} C^{-1}).
41	413	L	1955	489-884			Cast uranium; specimen heated from α-phase to β-phase and cooled again to α-phase; electrical resistivity reported as 44.7, 46.2, 54.2, 56.3, and 58.1 μohm cm at 202, 296, 405, 509, and 599 C, respectively.
42	418	L	1942	333.2		Tuballoy	Sintered; density 14.79 g cm^{-3} at about 25 C; the sintered uranium specimen contained possibly some uranium carbide.
43	418	L	1942	333.2		Tuballoy	Sintered and cold-pressed with 200 tons; density 17.22 g cm^{-3} at about 25 C; the sintered uranium specimen contained possibly some uranium carbide.
44	418	L	1942	334.2		Tuballoy	Pure; sintered; density 16.29 g cm^{-3} at about 25 C.
45	418	L	1942	334.2		Tuballoy	Pure; sintered; density 15.72 g cm^{-3} at about 25 C.
46	418	L	1942	336.2		Tuballoy	Fused; density 18.06 g cm^{-3} at about 25 C.
47	418	L	1942	335.2		Tuballoy	Fused; density 18.52 g cm^{-3} at about 25 C.

SPECIFICATION TABLE NO. 61 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
48	420	C	1957	407-932	±7.0		Pure; measured in a vacuum of 10^{-6} mm Hg; Armco iron used as comparative material.
49	421	C	1961	423-1023		Casting No. 747	< 0.005 each of K, P, Ti and Zn, 0.002 Si, < 0.002 each of Ca and Mo, 0.001-0.002 C, < 0.001 each of As and Na, 0.0003-0.0005 Fe, < 0.0005 each of Al, Be, Co, Ni, and Sn, 0.0004 Sb, 0.0003 Mg, 0.0001 Cu, < 0.0001 each of Ag, Bi, Cr, Li, and Pb, and < 0.00001 B; specimen 2 cm in dia and 15 cm long; machined from cast ingot; Armco iron used as comparative material.
50	422		1945	398-573			Pure; γ-extruded; measured in argon.
51	396		1954	293-1173			Average values for two specimens measured.
52	604	R	1943	357-514			Hollow cylinder; extruded.
53	605	P	1955	323.2			Specimen in the shape of a sphere; cast by Westinghouse Co.; thermal conductivity value calculated from measured thermal diffusivity using the specific heat value of 0.026 cal g^{-1} C^{-1} and the density 18.6 g cm^{-3}.
54	605	C	1955	323.2	10.0		Specimen 2 in. in dia and 1.31 in. long; cast by Westinghouse Co.; cold rolled iron used as comparative material (reference value ~~0.010~~ 0.12 cal cm^{-1} sec^{-1} C^{-1}).
55	605	L, C	1955	323.2	10.0		Porous specimen 2.5 cm x 2 cm x 2.05 cm; prepared from sintered metal powder by Metal Hydrides Corp; copper used as comparative material (reference value 0.91 cal cm^{-1} sec^{-1} C^{-1}).
56	538	L	1956	293-973	5.0		Pure; measured in a vacuum of about 1 x 10^{-4} mm Hg.
57	606	L	1954	334-873			In α-phase; cast; electrical resistivity reported as 34.48, 38.62, 42.76, 46.90, 51.04, 55.18, 59.32, 61.39, and 56.74 μohm cm at 0, 100, 200, 300, 400, 500, 600, 650, and 690 C, respectively.
58	607	P	1954	323-1048			Specimen 0.125 in. in dia; Ames uranium; thermal conductivity values calculated from measured data of thermal diffusivity.
59	416	L	1956	285-776		Canadian extruded No. 2	0.026 Si, 0.0188 Fe, 0.0036 Ni, 0.0030 Mn, 0.0010 Cu, 0.0009 Cr, 0.0001 Co, and 0.00005 Ag; prepared from a bar of metal refined in Canada and extruded in the γ-phase at a temp between 800 and 900 C by Bureau of Mines; specimen approx 2.5 cm in dia and 8.0 cm in length; ends plated with Ni and Cu, tinned to the main heater and the heat sink at approx 250 C for 1 hr, then cooled to room temp; heated to 600 C and held for 45 min for bonding; measured in vacuum.
60	416	L	1956	471.2		Canadian extruded No. 2	The above specimen remounted and heated to 750 C for 15 min to set bonds.
61	416	L	1956	677-979		Canadian extruded No. 2	The above specimen heated to 700 C and cooled to room temp prior to the measurement; measured with decreasing temp.
62	416	L	1956	480-875		Canadian extruded No. 2	The above specimen heated to 300 C and cooled to room temp prior to the measurement.

SPECIFICATION TABLE NO. 64 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
63	416	L	1956	293-781		Chalk River No. 1	Specimen approx 2.5 cm in dia and 8.0 cm in length; ends-plated with Ni and Cu, tinned to the main heater and heat sink at approx 250 C for 1 hr, then cooled to room temp; measured in vacuum.
64	416	L	1956	432-687		Chalk River No. 2	Similar to above.
65	416	L	1956	497-738		Chalk River No. 2	The above specimen remounted.
66	416	L	1956	298-683		Chalk River No. 3	Similar to the above specimen.
67	416	L	1956	474-726		Chalk River No. 3	The above specimen remounted.
68	730	L	1945	301-333	2	C-241-7A	Pure; prepared from a rolled rod; heated 2 hrs at 850 C and water quenched.
69	730	L	1945	304-333	2	C-245-1	Pure; prepared from a rolled rod.
70	800	C	1966	422-819	5.0	13	Specimen 2.5 cm in dia and 17.7 cm long; Springfield uranium; β-quenched and α-annealed; Armco iron used as comparative material.
71	910	P	1953	337-588			Specimen 0.125 in. in dia and 30 cm long; swaged from a Hanford uranium slug and annealed; thermal conductivity values calculated from the measured data of thermal diffusivity using the density and specific heat data of Katz, J. J. and Rabinowitch, E. ("The Chemistry of Uranium", McGraw-Hill, pp. 144-8, 158).
72	910	P	1953	481-693			Another run of the above specimen.
73	911	C	1965	333.2			0.05-0.12 Al, 0.1 C, 0.02-0.05 Fe, 0.01 total of N, O and Si; Springfields standard adjusted uranium; specimen 2.9 cm in dia and 7.5 cm long; cast; heat treated by traverse water quenching in the beta phase (666-760 C) followed by an anneal for 1 hr at 550 C; Armco iron used as comparative material.
74	911	C	1965	333.2			Similar to the above specimen.
75	911	C	1965	333.2			Similar to the above specimen.
76	911	C	1965	333.2			Similar to the above specimen.
77	911	C	1965	333.2			Similar to the above specimen.
78	911	C	1965	333.2			Similar to the above specimen.
79	911	C	1965	333.2			Similar to the above specimen.
80	911	C	1965	333.2			Similar to the above specimen.
81	911	C	1965	333.2			Similar to the above specimen except annealed at 450 C for 3000 hrs.
82	911	C	1965	333.2			Similar to the above specimen.
83	911	C	1965	333.2			Similar to the above specimen.
84	911	C	1965	333.2			Similar to the above specimen except annealed at 450 C for 10000 hrs.

SPECIFICATION TABLE NO. 64 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
85	911	C	1965	333.2			Similar to the above specimen.
86	911	C	1965	333.2			Similar to the above specimen.
87	911	C	1965	333.2			Similar to the above specimen.
88	911	C	1965	333.2			0.05-0.12 Al, 0.1 C, 0.02-0.05 Fe, 0.01 total of N, O and Si; irradiated Springfields standard adjusted uranium; specimen 2.9 cm in dia and 7.5 cm long; cast; heat treated by traverse water quenching in the beta phase (666-760 C) followed by an anneal for 1 hr at 550 C; irradiated in the Calder Hall reactors at an estimated mean temp of 250 C with doses ranging from 1152 to 1932 MWD/te; Armco iron used as comparative material.
89	911	C	1965	333.2			Similar to the above specimens except irradiated at an estimated mean temp of 320 C with doses ranging from 3000 to 3298 MWD/te.
90	911	C	1965	333.2			Similar to the above specimen except irradiated at an estimated mean temp of 370 C with doses ranging from 659 to 1750 MWD/te.
91	911	C	1965	333.2			Similar to the above specimens except irradiated at an estimated mean temp of 395 to 415 C with doses ranging from 55 to 4660 MWD/te.
92	911	C	1965	333.2			Similar to the above specimens except irradiated at estimated mean temp 420 to 450 C with doses ranging from 985 to 3157 MWD/te.
93	843	–	1966	297.7			0.05 Fe, 0.01 Mg, 0.008 Mo, 0.005 Si, < 0.005 P, < 0.005 K, < 0.005 Ti, < 0.005 Zn, < 0.002 Ca, < 0.001 As, < 0.001 Na, 0.0005 Ni, < 0.0005 Al, < 0.0005 Co, < 0.0005 Sn, 0.0004 Mn, 0.0002 Cu, 0.0001 Pb, traces of Ag, Bi, Cr, Li, Sb, Be, and B; spherical powder obtained from National Lead Co.; contained in a 0.75 in. dia x 2 in. long stainless steel cylindrical cell; mesh size -16 + 20; grain size 1000 μ; thermal conductivity measured by the transient line source method; measured in nitrogen at atmospheric pressure.
94	843	–	1966	297-553			Same impurities, source, and measuring method as above; mesh size -70 + 80; grain size 190 μ; measured in nitrogen at atmospheric pressure.
95	843	–	1966	297-553			Same impurities, source, and measuring method as above; mesh size -230 + 325; grain size 50 μ; measured in nitrogen at atmospheric pressure.
96	843	–	1966	298.2			Same impurities, source, and measuring method as above; mesh size -16 + 20; average grain size 1000 μ; measured in nitrogen under pressures ranging from 2.85×10^{-5} to 8.71×10^{2} mm Hg.
97	843	–	1966	298.2			Same impurities, source, and measuring method as above; mesh size -40 + 50; average grain size 350 μ; measured in nitrogen under pressures ranging from 5.13×10^{-5} to 6.166×10^{3} mm Hg.
98	843	–	1966	298.2			Same impurities, source, and measuring method as above; mesh size -70 + 80; measured in nitrogen at 1 atm.
99	843	–	1966	298.2			Similar to above; measured in nitrogen under pressures ranging from 10^{-2} to 5.495×10^{3} mm Hg.

SPECIFICATION TABLE NO. 64 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
100	843	-	1966	298.2			Similar to above; measured in helium under pressures ranging from 10^{-2} to 3.589×10^3 mm Hg.
101	843	-	1966	298.2			Similar to above; measured in methane under pressures ranging from 10^{-2} to 3.715×10^3 mm Hg.
102	843	-	1966	298.2			Similar to above; measured in argon under pressures ranging from 10^{-2} to 5.370×10^3 mm Hg.
103	843	-	1966	298.2			Similar to above; measured in nitrogen under pressure ranging from 2.92×10^{-4} to 5.188×10^3 mm Hg.
104	843	-	1966	298.2			Same impurities, source, and measuring method as above; mesh size -170 + 200; average grain size 80 μ; measured in nitrogen under pressures ranging from 2.34×10^{-5} to 4.955×10^3 mm Hg.
105	843	-	1966	298.2			Same impurities, source, and measuring method as above; mesh size -230 + 325; average grain size 53 μ; measured in nitrogen under pressures ranging from 1.05×10^{-2} to 2.483×10^3 mm Hg.
106	843	-	1966	298.2			Same impurities, source, and measuring method as above; mesh size -230 + 325; measured in nitrogen at 1 atm.
107	843	-	1966	298.2			Similar to above; measured in nitrogen under pressures ranging from 0.01 to 3890 mm Hg.
108	912	C	1959	293-973			Specimen 0.5 in. in dia and 5.625 in. long; unirradiated, unclad national uranium; measured in a vacuum of 2×10^{-4} mm Hg; Armco iron used as comparative material; data reported here are ten times lower than the original data, which are believed to be wrong as the results of typographical error.
109	992	-	1966	354-1059			Total impurity content < 0.03; melted and cast in an alumina-coated graphite crucible; cooled and machined to desired dimensions; grain size ~0.25 mm; electrical resistivity reported as 33.8, 38.3, 44.3, 48.9, 53.8, 55.9, 57.5, 58.2, 56.0, 56.0, and 54.5 μohm cm at 81, 156, 234, 339, 440, 526, 570, 630, 682, 724, and 786 C respectively; Lorenz function reported as 2.17, 1.93, 2.82, 3.44, 3.51, 3.24, 3.37, and 3.30×10^{-8} V^2 K^{-2} at 96, 251, 467, 668, 670, 768, 773, and 801 C, respectively; thermal conductivity values originally used by the authors when deriving these Lorenz function values had been calculated from their measured data for specific heat and thermal diffusivity, present thermal conductivity values calculated (by TPRC) from reported electrical resistivity data and Lorenz function values.

DATA TABLE NO. 64 THERMAL CONDUCTIVITY OF URANIUM

(Impurity < 0.20% each, total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm⁻¹K⁻¹]

T	k
CURVE 1	
353.2	0.245
573.2	0.309
CURVE 2	
423.2	0.245
573.2	0.332
CURVE 3	
255.4	0.214
310.9	0.224
422.1	0.244
533.2	0.265
644.3	0.287
755.4	0.311
866.5	0.336
CURVE 4	
255.4	0.226
310.9	0.235
422.1	0.254
533.2	0.274
644.3	0.293
755.4	0.312
866.5	0.332
933.2	0.348
949.8	0.359
977.6	0.369*
1005.4	0.379
1033.2	0.389
CURVE 5	
23.12	0.124
25.89	0.133
45.51	0.156
66.59	0.190
80.42	0.205
111.2	0.227
CURVE 5 (cont.)	
197.0	0.254
277.6	0.283
277.8	0.282*
CURVE 6*	
313	0.236
373	0.255
CURVE 7*	
313	0.249
373	0.262
CURVE 8	
313	0.234
373	0.250
CURVE 9*	
313	0.247
373	0.259
CURVE 10	
2.45	0.0257
2.96	0.0336
4.60	0.0470
6.75	0.0743
8.98	0.0926
12.86	0.112
14.70	0.128
17.75	0.152
21.75	0.164
26.10	0.168
35.71	0.175
62.70	0.201
85.50	0.252
94.10	0.276
CURVE 11*	
406.7	0.243
414.4	0.246
433.2	0.252
453.2	0.259
473.2	0.264
493.2	0.270
513.2	0.275
533.7	0.279
CURVE 12	
340.2	0.258
348.2	0.259
373.2	0.264
398.2	0.270
423.2	0.281
448.2	0.291
473.2	0.299
498.2	0.305
523.2	0.308
548.2	0.312
573.2	0.314
598.2	0.316
623.2	0.320
648.2	0.324
673.2	0.327
698.2	0.331
711.2	0.333
CURVE 13	
373.2	0.263
473.2	0.286
573.2	0.309
673.2	0.331
773.2	0.354
873.2	0.377
973.2	0.400
1073.2	0.423
1173.2	0.446
CURVE 14	
343.2	0.146
CURVE 15	
303.8	0.259
310.3	0.272
319.7	0.272
328.7	0.276
339.1	0.280
CURVE 16	
343.2	0.293
CURVE 17	
343.2	0.293
CURVE 18*	
343.2	0.297
CURVE 19	
343.2	0.300
CURVE 20	
343.2	0.272
CURVE 21	
343.2	0.270
CURVE 22	
2.1	0.0285
2.4	0.0290
2.5	0.0265
3.0	0.0325
CURVE 22 (cont.)	
3.6	0.044
4.6	0.047
6.9	0.0745
9.2	0.0935
12.7	0.113
14.8	0.129
20.9	0.162
CURVE 23*	
373.2	0.291
473.2	0.311
573.2	0.332
673.2	0.352
773.2	0.373
873.2	0.393
923.2	0.403
CURVE 24	
373.2	0.276
473.2	0.289
573.2	0.302
673.2	0.315
773.2	0.328
873.2	0.342
923.2	0.349
CURVE 25	
311.2	0.255
318.2	0.255
353.2	0.264
383.2	0.268
398.2	0.285
423.2	0.301
548.2	0.347
CURVE 26	
323.2	0.243
358.2	0.259
408.2	0.272
458.2	0.293
CURVE 27	
293.2	0.240
373.2	0.255
473.2	0.275
573.2	0.300
673.2	0.325
773.2	0.355
873.2	0.390
973.2	0.425
1073.2	0.460
CURVE 28	
293.1	0.235
332.6	0.237
344.1	0.241
370.5	0.246
375.1	0.247
422.3	0.254
469.4	0.264
473.2	0.264
CURVE 29	
290.9	0.234
344.1	0.242
399.0	0.249
422.1	0.254
CURVE 30	
469.9	0.275
567.9	0.295
1002.6	0.374
CURVE 31	
420.4	0.271
666.5	0.317
CURVE 32	
470.4	0.280
572.2	0.297
CURVE 33*	
573.9	0.300
CURVE 34	
573.5	0.308
674.8	0.336
872.3	0.395
CURVE 35*	
303.7	0.263
478.1	0.285
570.5	0.305
679.4	0.333
878.4	0.387
CURVE 36	
477.3	0.290
782.2	0.361
877.3	0.400
CURVE 37	
299.3	0.261
374.0	0.272
476.6	0.290
476.9	0.289
477.2	0.289
580.0	0.312
CURVE 37* (cont.)	
580.4	0.316
678.4	0.344
679.7	0.348
776.4	0.375
776.7	0.382
874.2	0.423
876.3	0.419
876.5	0.407
876.7	0.416
877.2	0.429
878.3	0.428
CURVE 38*	
476.6	0.300
476.7	0.297
476.7	0.295
476.8	0.299
477.3	0.293
477.4	0.300
677.5	0.465
877.5	0.474
877.5	0.474
877.5	0.487
878.1	0.451
878.2	0.438
878.2	0.447
CURVE 39*	
475.1	0.303
475.5	0.329
475.5	0.320
476.0	0.309
476.0	0.312
476.3	0.313
580.4	0.343
680.0	0.391
778.3	0.436
853.8	0.486

* Not shown on plot

DATA TABLE NO. 64 (continued)

T	k
CURVE 39* (cont.)	
877.3	0.485
877.6	0.482
877.8	0.505
CURVE 40*	
323.2	0.238
373.2	0.249
423.2	0.259
473.2	0.269
523.2	0.279
573.2	0.290
CURVE 41*	
489.2	0.286
654.2	0.325
858.2	0.344
884.2	0.353
CURVE 42*	
333.2	0.240
CURVE 43	
333.2	0.183
CURVE 44	
334.2	0.182
CURVE 45	
334.2	0.175
CURVE 46	
336.2	0.191
CURVE 47	
335.2	0.202
CURVE 48*	
407.0	0.291
540.7	0.296
588.5	0.296
687.2	0.320
735.0	0.315
795.5	0.352
798.7	0.364
801.9	0.341
836.9	0.359
865.6	0.328
865.6	0.372
878.3	0.392
881.5	0.359
884.7	0.356
907.0	0.400
907.0	0.397
916.5	0.406
916.5	0.398
926.1	0.342
926.1	0.397
932.4	0.397
CURVE 49*	
423.2	0.285
473.2	0.293
523.2	0.303
573.2	0.315
623.2	0.323
673.2	0.333
723.2	0.346
773.2	0.362
823.2	0.377
873.2	0.391
923.2	0.410
973.2	0.439
1023.2	0.469
CURVE 50*	
397.7	0.265
455.2	0.285
517.2	0.298
573.2	0.317
CURVE 51*	
293.2	0.26
373.2	0.27
473.2	0.29
573.2	0.31
673.2	0.33
773.2	0.36
873.2	0.39
973.2	0.43
1073.2	0.48
1173.2	0.52
CURVE 52*	
357.2	0.261
400.2	0.262
419.2	0.263
456.2	0.275
476.2	0.278
514.2	0.287
CURVE 53*	
323.2	0.247
CURVE 54	
323.2	0.201
CURVE 55	
323.2	0.155
CURVE 56*	
293.2	0.243
373.2	0.258
473.2	0.284
573.2	0.299
673.2	0.320
773.2	0.343
873.2	0.371
973.2	0.395
CURVE 57*	
334.2	0.277
420.2	0.291
479.2	0.291
483.2	0.289
484.2	0.294
491.2	0.300
595.2	0.324
663.2	0.323
672.2	0.321
674.2	0.326
685.2	0.347
769.2	0.347
873.2	0.356
CURVE 58*	
323.2	0.216
343.2	0.222
398.2	0.232
428.2	0.237
488.2	0.252
553.2	0.275
610.2	0.294
665.2	0.320
768.2	0.360
853.2	0.382
923.2	0.415
943.2	0.420
943.2	0.430
978.2	0.440
1018.2	0.460
1048.2	0.447
CURVE 59*	
284.6	0.247
310.3	0.249
331.4	0.253
377.5	0.261
426.6	0.270
474.0	0.283
475.1	0.280
577.8	0.302
676.1	0.326
776.0	0.364
CURVE 60	
471.2	0.292
CURVE 61	
677.4	0.346
776.9	0.380
878.2	0.409
979.3	0.459
CURVE 62	
479.5	0.300
587.2	0.333
676.3	0.358
778.2	0.392
875.2	0.423
CURVE 63	
292.7	0.233
359.2	0.244
365.1	0.246
376.1	0.273
387.7	0.251
396.7	0.255
432.1	0.287
433.2	0.263
485.2	0.299
488.2	0.298
489.7	0.274
529.7	0.284
531.3	0.310
563.2	0.293
577.2	0.322
601.7	0.305
630.7	0.310
672.2	0.323
703.2	0.331
741.9	0.346
780.7	0.360
CURVE 64	
431.7	0.279
434.8	0.279
CURVE 64* (cont.)	
436.2	0.279
490.4	0.287
500.2	0.292
535.4	0.299
535.4	0.299
586.4	0.310
636.9	0.323
686.9	0.333
CURVE 65*	
496.8	0.290
535.9	0.302
584.2	0.309
634.4	0.325
684.3	0.339
738.0	0.352
CURVE 66	
297.7	0.247
363.7	0.259
426.3	0.272
465.4	0.280
522.2	0.292
525.1	0.291
573.0	0.302
624.2	0.318
683.2	0.333
CURVE 67	
474.2	0.283
599.8	0.310
676.2	0.335
723.2	0.347
724.2	0.351
725.8	0.350
CURVE 68	
301.4	0.276
307.0	0.272
313.7	0.280
319.8	0.285
CURVE 68* (cont.)	
326.2	0.280
333.4	0.285
CURVE 69*	
303.5	0.276
304.4	0.276
312.0	0.280
317.2	0.280
323.0	0.285
332.6	0.285
CURVE 70	
422	0.303
526	0.308
614	0.335
648	0.353
685	0.361
754	0.373
812	0.401
823	0.397
819	0.414
CURVE 71*	
336.9	0.275
365.9	0.281
380.2	0.281
539.4	0.313
588.4	0.323
CURVE 72*	
480.8	0.304
609.3	0.336
693.2	0.364
CURVE 73*	
333.2	0.265
CURVE 74*	
333.2	0.267
CURVE 75*	
333.2	0.267
CURVE 76*	
333.2	0.268
CURVE 77*	
333.2	0.268
CURVE 78*	
333.2	0.270
CURVE 79*	
333.2	0.271
CURVE 80*	
333.2	0.272
CURVE 81*	
333.2	0.270
CURVE 82*	
333.2	0.272
CURVE 83*	
333.2	0.275
CURVE 84*	
333.2	0.276
CURVE 85*	
333.2	0.277
CURVE 86*	
333.2	0.277

*Not shown on plot

DATA TABLE NO. 64 (continued)

CURVE 87*

T	k
333.2	0.279

CURVE 88*
T = 333.2 K

Irradiation Level (MWD/te)	k
1152	0.231
1152	0.232
1152	0.235
1163	[illegible]
1889	[illegible]
1932	[illegible]

CURVE 89*
T = 333.2 K

Irradiation Level (MWD/te)	k
3000	0.245
3060	0.248
3298	0.246

CURVE 90*
T = 333.2 K

Irradiation Level (MWD/te)	k
659	0.254
680	0.251
[illegible]	0.253
1750	0.251

CURVE 91*
T = 333.2 K

Irradiation Level (MWD/te)	k
55	0.257
1901	0.259
3330	0.250
3337	0.251
3570	0.249
4660	0.257

CURVE 92*
T = 333.2 K

Irradiation Level (MWD/te)	k
985	0.259
1090	0.254
1330	0.252
1670	0.246

CURVE 92 (cont.)*

Irradiation Level (MWD/te)	k
2801	0.249
3157	0.259

CURVE 93

T	k
297.7	0.00420

CURVE 94*

T	k
297.3	0.00319
423.3	0.00379
553.1	0.00443

CURVE 95*

T	k
297.4	0.00228
423.1	0.00293
553.1	0.00341

CURVE 96*
T = 298.2 K

p (mm Hg)	k
0.0000285	0.0000766
0.00275	0.000150
0.0422	0.000427
0.260	0.000799
11.4	0.00274
861	0.00423
871	0.00411

CURVE 97
T = 298.2 K

p (mm Hg)	k
0.0000513	0.0000812*
0.000197	0.0000874*
0.00631	0.000178*
1.38	0.000816*
14.8	0.00298*
130	0.00427*
3162	0.00460
4519	0.00435
6166	0.00444

CURVE 98*

T	k
298.2	0.00439

CURVE 99*
T = 298.2 K

p (mm Hg)	k
0.010	0.0000979*
0.556	0.000208*
0.912	0.000235*
22.9	0.00132
143	0.00246
794	0.00325*
3236	0.00340
5495	0.00344*

CURVE 100
T = 298.2 K

p (mm Hg)	k
0.010	0.000106*
0.813	0.000300*
1.41	0.000404*
28.2	0.00296
155	0.00745*
794	0.0119
1950	0.0123*
3589	0.0129*

CURVE 101*
T = 298.2 K

p (mm Hg)	k
0.010	0.0000866
1.43	0.000435
23.7	0.00203
148	0.00392
785	0.00586
3715	0.00720

CURVE 102*
T = 298.2 K

p (mm Hg)	k
0.010	0.0000316
1.53	0.000373
30.6	0.00111
140	0.00170
832	0.00227
3055	0.00252
5370	0.00255

CURVE 103*
T = 298.2 K

p (mm Hg)	k
0.0000292	0.0000348
0.000507	0.0000398
0.00646	0.0000941
0.0741	0.000244
0.724	0.000411
22.7	0.00136
150	0.00244
664	0.00315
3388	0.00336
5188	0.00345

CURVE 104*
T = 298.2 K

p (mm Hg)	k
0.0000234	0.0000238
0.00102	0.0000245
0.00282	0.0000310
0.0610	0.0000732
0.367	0.000153
10.5	0.000728
157	0.00205
804	0.00302
2951	0.00310
4955	0.00310

CURVE 105*
T = 298.2 K

p (mm Hg)	k
0.0105	0.0000409
1.06	0.000248
10.4	0.000561
102	0.00136
1072	0.00233
2483	0.00264

CURVE 106*

T	k
298.2	0.00339

CURVE 107*
T = 298.2 K

p (mm Hg)	k
0.0100	0.0000418
13.2	0.000632
120	0.00151
389	0.00202
881	0.00239
1905	0.00254
3890	0.00255

CURVE 108*

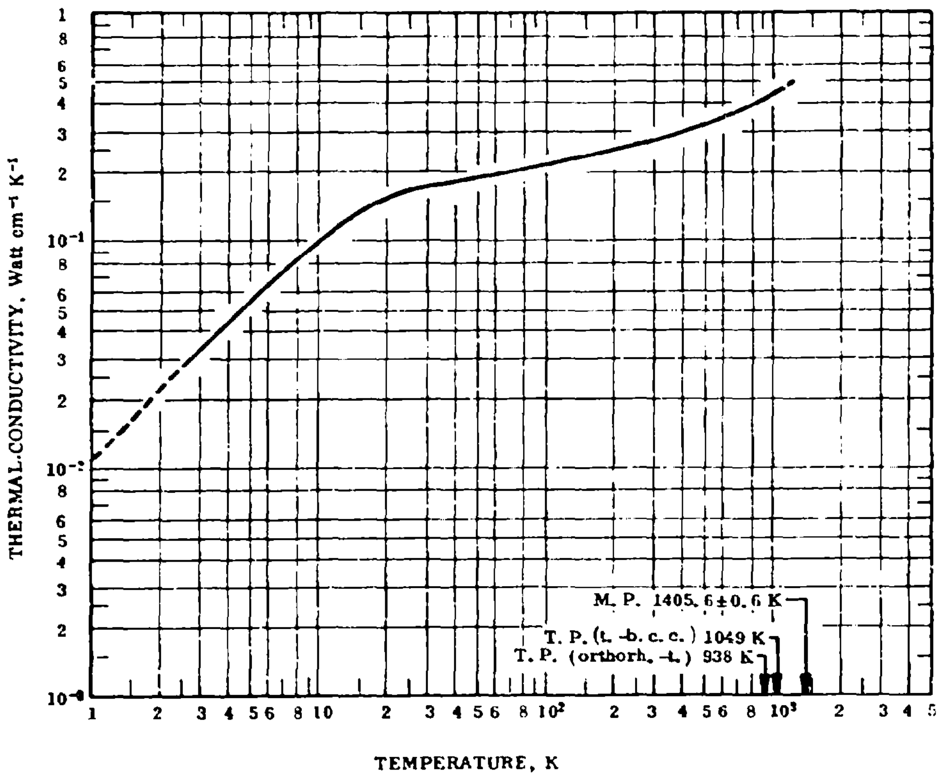
T	k
293.2	0.240
373.2	0.255
473.2	0.275
573.2	0.302
673.2	0.326
773.2	0.355
873.2	0.390
973.2	0.425

CURVE 109*

T	k
354.2	0.228
429.2	0.233
497.2	0.219
612.2	0.289
713.2	0.361
799.2	0.430
843.2	0.463
903.2	0.518
955.2	0.594
997.2	0.595
1059	0.649

*Not shown on plot

FIGURE AND TABLE NO. 64R RECOMMENDED THERMAL CONDUCTIVITY OF URANIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.0114)‡	(0.659)	-457.9
2	(0.0228)	(1.32)	-456.1
3	0.0338	1.95	-454.3
4	0.0442	2.55	-452.5
5	0.0541	3.13	-450.7
6	0.0638	3.69	-448.9
7	0.0731	4.22	-447.1
8	0.0818	4.73	-445.3
9	0.0898	5.19	-443.5
10	0.0960	5.66	-441.7
11	0.106	6.12	-439.9
12	0.113	6.53	-438.1
13	0.120	6.93	-436.3
14	0.126	7.28	-434.5
15	0.132	7.63	-432.7
16	0.138	7.97	-430.9
18	0.149	8.61	-427.3
20	0.158	9.13	-423.7
25	0.167	9.65	-414.7
30	0.173	10.0	-405.7
35	0.178	10.3	-396.7
40	0.182	10.5	-387.7
45	0.186	10.7	-378.7
50	0.189	10.9	-369.7
60	0.196	11.3	-351.7
70	0.202	11.7	-333.7
80	0.208	12.0	-315.7
90	0.212	12.2	-297.7
100	0.217	12.5	-279.7
150	0.236	13.6	-189.7
200	0.251	14.5	- 99.7
250	0.264	15.3	- 9.7
273.2	0.270	15.6	32.0
300	0.276	15.9	80.3
350	0.286	16.5	170.3
400	0.296	17.1	260.3

T_1	k_1	k_2	T_2
500	0.317	18.3	440.3
600	0.340	19.6	620.3
700	0.364	21.0	800.3
800	0.388	22.4	980.3
900	0.413	23.9	1160
1000	0.439	25.4	1340
1100	0.463	26.8	1520
1200	(0.490)	(28.3)	1700

REMARKS

The recommended values are for well-annealed high-purity uranium with residual electrical resistivity $\rho_0 = 2.2\ \mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 200 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

FIGURE SHOWS ONLY 22 OF THE CURVES REPORTED IN TABLE

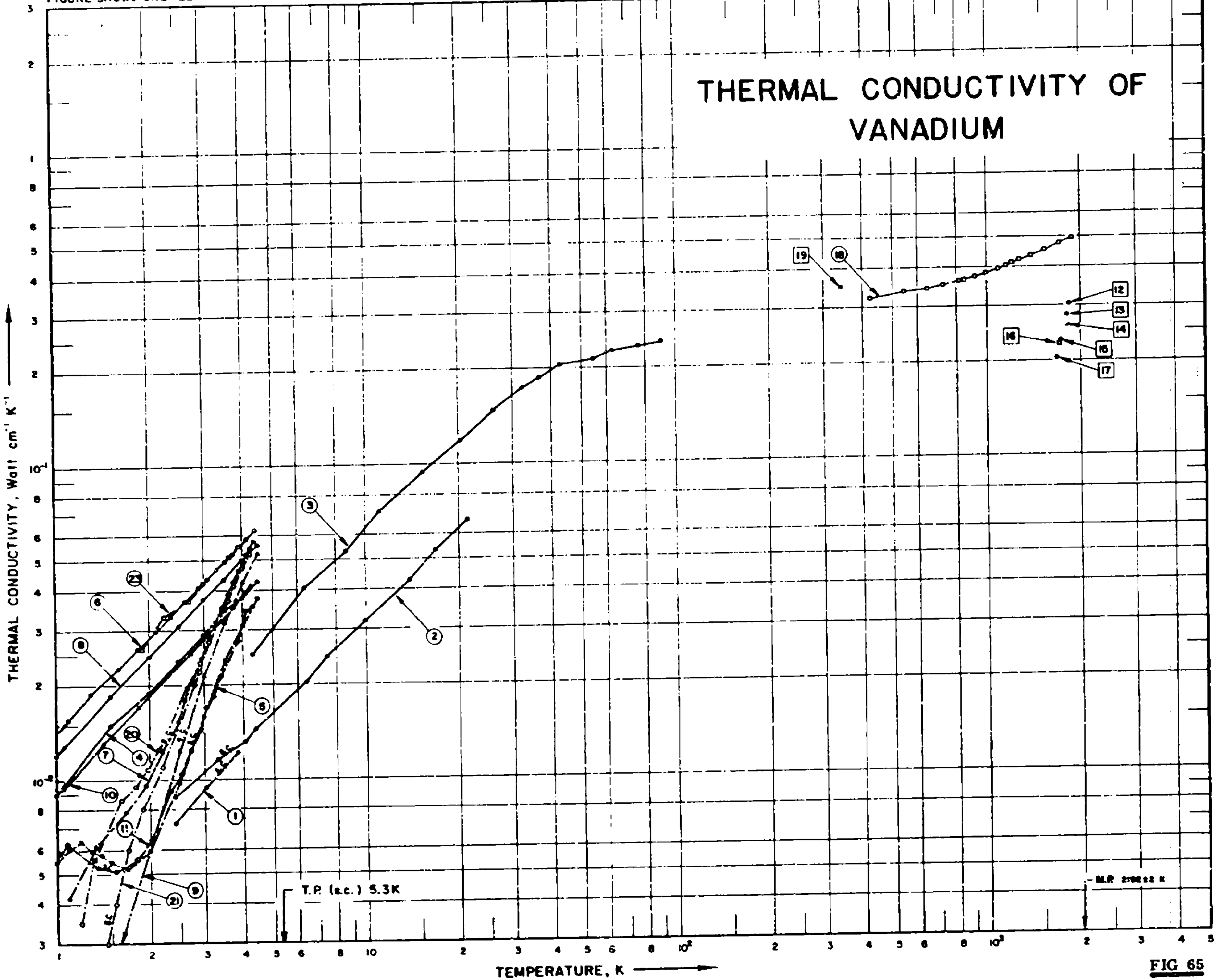


FIG 65

SPECIFICATION TABLE NO. 65 THERMAL CONDUCTIVITY OF VANADIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 65]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	122	L	1955	2.4-3.84	3	V 1	Polycrystalline; specimen 0.725 cm long, 0.0995 cm in dia; made from spectrographically standardized metal from Johnson, Matthey and Co.; in superconducting state.
2	122	L	1955	2.4-21		V 1	The above specimen measured in a magnetic field; in normal state.
3	151	L	1957	4.3-90		V 4	Approx. 99.9 pure; obtained from Electrometallurgical Co.; specimen 0.55 mm in dia; annealed in vacuo at 1300 C; residual electrical resistivity ρ_0 - 4.83 μohm cm; ideal electrical resistivity reported as 0.014, 0.036, 0.14, 0.38, 0.74, 2.3, 4.25, 8.7, 12.95, 16.65, 18.3, and 19.9 μohm cm at 15, 20, 30, 40, 50, 75, 100, 150, 200, 250, 273, and 295 K, respectively.
4	389	L	1958	0.5-4.5		V I	Single crystal; in normal state.
5	389	L	1958	1.0-4.5		V I	The above specimen in superconducting state.
6	389	L	1958	0.18-4.4		V II	Single crystal; in normal state.
7	389	L	1958	1.1-4.4		V II	The above specimen in superconducting state.
8	389	L	1958	0.2-4.5			Polycrystalline; in normal state.
9	389	L	1958	1.5-4.5			The above specimen in superconducting state.
10	501	L	1961	1.1-4.3		V II	0.05 Fe, 0.01 Si, 0.005 Mo, 0.0005 Mn, and 0.0003 Cu; single crystal; specimen obtained by floating-zone melting of polycrystalline rods; measured in magnetic field of 6200 oersteds; in normal state.
11	501	L	1961	0.92-4.3		V II	The above specimen measured with the magnetic field removed; in superconducting state.
12	601	-	1962	1840			Specimen 0.50 in. in dia and 0.442 in. thick; heated in high vacuum (10^{-5}mm Hg) by high frequency induction to 1000-3000 C; localized heating within 0.003 in. of the surface at current frequency of 500000 cps; heat lost only by radiation, cylindrical surface assumed isothermal, and the temperature gradient along the radius analytically correlated to the thermal conductivity, run No. 1.
13	601	-	1962	1807.5			The above specimen, run No. 3.
14	601	-	1962	1801.5			The above specimen, run No. 4.
15	601	-	1962	1729			The above specimen, run No. 6.
16	601	-	1962	1707.5			The above specimen, run No. 7.
17	601	-	1962	1674.5			The above specimen, run No. 8.
18	614	R	1961	423-1876	<5		99.74 V, 0.073 O, 0.048 Fe, 0.043 N, and 0.042 C; specimen composed of 5 one-inch dia disks; hot rolled and annealed; density 6.05 g cm^{-3}.

SPECIFICATION TABLE NO. 65 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
19	760	C	1955	343	±3		99.6⁺ pure, calcium reduced vanadium from the Electrometallurgical Co.; Armco iron used as comparative material.
20	677	L	1960	1.2-4.4			Single crystal; ~50 mm long, 4 mm in dia; prepared by 'floating zone' technique; in superconducting state.
21	677	L	1960	1.5-4.3			The above specimen irradiated to a dose of 10^{18} fast neutrons cm^{-2}; in superconducting state.
22	677	L	1960	1.4-3.2			The above specimen measured before irradiation; in normal state.
23	677	L	1960	1.9-4.4			The above specimen measured after irradiated to a dose of 10^{18} fast neutrons cm^{-2}; in normal state.

DATA TABLE NO. 65 THERMAL CONDUCTIVITY OF VANADIUM

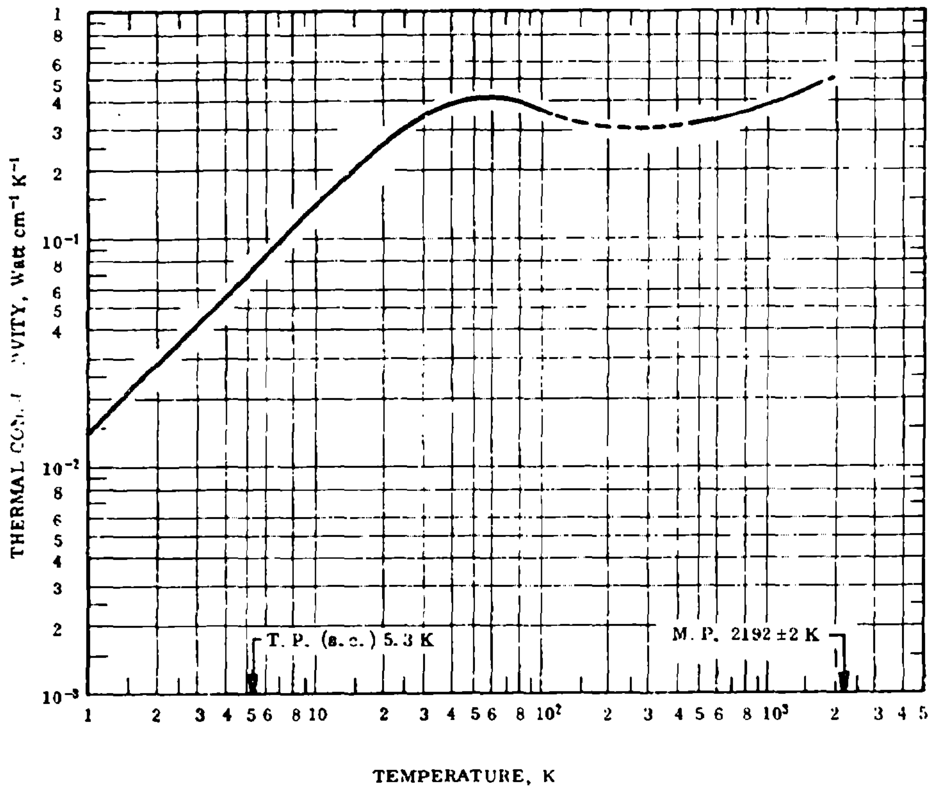
(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
2.40	0.0072
3.06	0.0094
3.84	0.0122
CURVE 2	
2.40	0.0088
3.31	0.0116
4.05	0.0132
4.38	0.0145
6.40	0.0204
7.44	0.0245
9.92	0.0318
13.84	0.0428
16.78	0.0531
21.32	0.0663
CURVE 3	
4.30	0.0250
6.35	0.0405
8.65	0.0530
11.15	0.0710
15.40	0.0943
20.40	0.118
26.00	0.147
32.30	0.173
36.55	0.186
42.70	0.205
54.60	0.214
63.10	0.227
76.55	0.234
90.20	0.241
CURVE 4	
0.5	0.004*
1.0	0.009
1.5	0.014
2.0	0.019
2.5	0.024
CURVE 4 (cont.)	
3.0	0.029
3.5	0.0346
4.0	0.038
4.5	0.043
CURVE 5	
1.0	0.0055
1.1	0.0061
1.2	0.0064
1.3	0.0060
1.4	0.0058
1.5	0.0055
1.7	0.0052
2.0	0.0060
2.5	0.0098
3.0	0.016
3.5	0.024
4.0	0.031
4.5	0.038
CURVE 6	
0.18	0.0022*
0.38	0.0053*
0.60	0.0085*
0.86	0.0120*
1.10	0.0156
1.30	0.0188
1.60	0.0226
1.85	0.0262
2.12	0.0298
2.36	0.0333
2.61	0.0370
2.90	0.0410
3.10	0.0435
3.30	0.0468
3.53	0.0497
3.74	0.0523
3.97	0.0558
4.16	0.0589
4.41	0.0622
CURVE 7	
1.10	0.0042
1.35	0.0062
1.68	0.0078
1.94	0.0096
2.20	0.0123
2.48	0.0153
2.60	0.0180
2.76	0.0208
2.95	0.0245
3.14	0.0285
3.28	0.0318
3.45	0.0354
3.60	0.0390
3.74	0.0426
3.90	0.0462
4.04	0.0495
4.15	0.0520
4.27	0.0550
4.38	0.0575
CURVE 8	
0.20	0.0020*
0.50	0.0060*
1.0	0.0120
1.5	0.0185
2.0	0.0248
2.5	0.0310
3.0	0.0375
3.5	0.0435
4.0	0.050
4.5	0.056
CURVE 9	
1.5	0.0025*
2.0	0.0060*
2.5	0.0123
3.0	0.0215
3.5	0.0316
4.0	0.0425
4.5	0.0526
CURVE 10	
1.05	0.0095
1.42	0.0131
1.85	0.0173
2.72	0.0255
2.90	0.0272
3.00	0.0285
3.14	0.0294
3.42	0.0323
3.75	0.0355
4.10	0.0394
4.30	0.0414
CURVE 11	
0.92	0.0051*
1.08	0.0063
1.36	0.0053
1.55	0.0051
1.83	0.0056
2.03	0.0065
2.33	0.0092
2.54	0.0105
2.73	0.0124
2.94	0.0145
3.05	0.0170
3.22	0.0185
3.40	0.0214
3.88	0.0276
4.12	0.0345
4.32	0.0353
CURVE 12	
1840	0.303
CURVE 13	
1807.5	0.279
CURVE 14	
1801.5	0.260
CURVE 15	
1729	0.232
CURVE 16	
1707.5	0.227
CURVE 17	
1674.5	0.204
CURVE 18	
423.2	0.324
542.1	0.340
643.2	0.346
724.8	0.357
818.2	0.366
847.1	0.369
918.7	0.377
993.7	0.385
1088.7	0.396
1162.6	0.404
1211.5	0.414
1274.8	0.421
1392.1	0.434
1539.8	0.452
1716.5	0.475
1875.4	0.495
CURVE 19	
343	0.351
CURVE 20	
1.2	0.0035
1.32	0.0056
1.62	0.0086
1.80	0.0095
1.98	0.0108
2.15	0.0125
2.64	0.0195
CURVE 20 (cont.)	
2.92	0.0235
3.28	0.0316*
3.51	0.0360*
3.81	0.0435*
4.10	0.0495*
4.20	0.0535*
4.35	0.0575*
CURVE 21	
1.45	0.003
1.55	0.004
1.70	0.006
1.90	0.008
2.20	0.01
2.48	0.015*
2.80	0.020
2.90	0.022
3.13	0.0275
3.38	0.032*
3.60	0.037
3.78	0.041
4.0	0.047
4.25	0.052
CURVE 22*	
1.35	0.019
1.70	0.024
1.85	0.027
2.25	0.032
2.65	0.039
3.15	0.045
CURVE 23	
1.90	0.026
2.25	0.033
2.70	0.037
3.00	0.042
3.30	0.046*
3.65	0.051
CURVE 23 (cont.)	
3.90	0.055
4.40	0.062*

*Not shown on plot

FIGURE AND TABLE NO. 65R RECOMMENDED THERMAL CONDUCTIVITY OF VANADIUM



RECOMMENDED VALUES*

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.331	19.1	440.3
1	0.0142	0.820	-457.9	600	0.342	19.8	620.3
2	0.0282	1.63	-456.1	700	0.352	29.3	800.3
3	0.0422	2.44	-454.3	800	0.363	21.0	980.3
4	0.0561	3.24	-452.5	900	0.374	21.6	1160
5	0.0697	4.03	-450.7	1000	0.386	22.3	1340
6	0.0835	4.82	-448.9	1100	0.396	22.9	1520
7	0.0971	5.61	-447.1	1200	0.412	23.8	1700
8	0.111	6.41	-445.3	1300	0.424	24.5	1880
9	0.125	7.22	-443.5	1400	0.436	25.2	2060
10	0.138	7.97	-441.7	1500	0.447	25.8	2240
11	0.151	8.72	-439.9	1600	0.460	26.6	2420
12	0.165	9.53	-438.1	1700	0.473	27.3	2600
13	0.177	10.2	-436.3	1800	0.484	28.0	2780
14	0.190	11.0	-434.5	1900	(0.497)	(28.7)	2960
15	0.202	11.7	-432.7	2000	(0.509)	(29.4)	3140
16	0.214	12.4	-430.9				
18	0.237	13.7	-427.3				
20	0.258	14.9	-423.7				
25	0.305	17.6	-414.7				
30	0.342	19.8	-405.7				
35	0.369	21.3	-396.7				
40	0.389	22.5	-387.7				
45	0.401	23.2	-378.7				
50	0.405	23.4	-369.7				
60	0.406	23.5	-351.7				
70	0.402	23.2	-333.7				
80	0.390	22.5	-315.7				
90	0.373	21.6	-297.7				
100	(0.357)‡	(20.6)	-279.7				
150	(0.324)	(18.7)	-189.7				
200	(0.315)	(18.2)	-99.7				
250	(0.312)	(18.0)	-9.7				
273.2	(0.313)	(18.1)	32.0				
300	(0.315)	(18.2)	80.3				
350	(0.318)	(18.4)	170.3				
400	(0.321)	(18.5)	260.3				

REMARKS

The recommended values are for well-annealed high-purity vanadium with residual electrical resistivity $\rho_0 = 1.72\ \mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 150 K). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or interpolated.

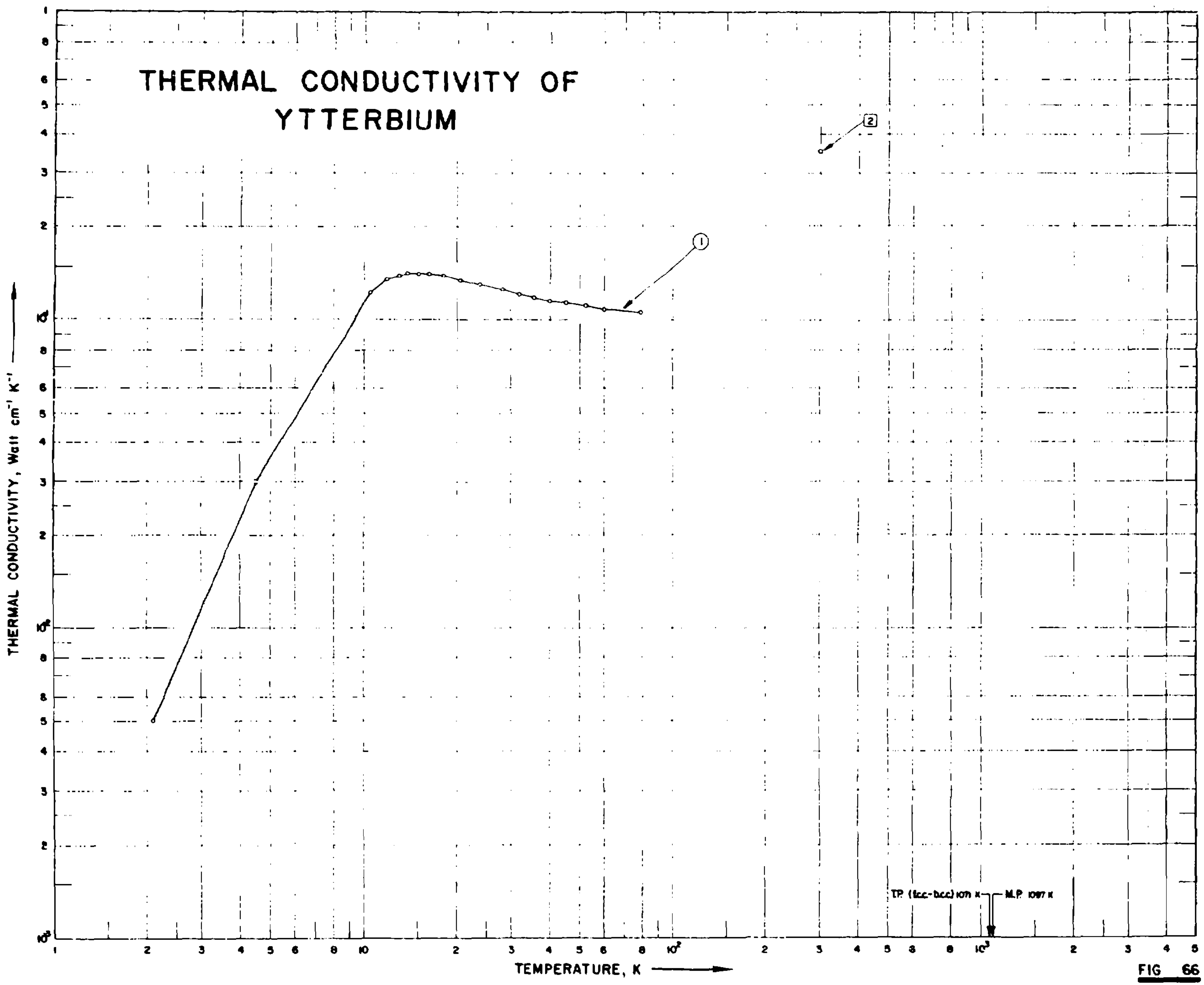

THERMAL CONDUCTIVITY OF YTTERBIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
T.P. (fcc-bcc) 1071 K
M.P. 1097 K

FIG 66

SPECIFICATION TABLE NO. 66 THERMAL CONDUCTIVITY OF YTTERBIUM

(Impurity 0.20% each; total impurities 0.50%)

[For Data Reported in Figure and Table No. 66]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	994 820	L	1965	2.1-79			99.99 pure; polycrystalline; strip specimen 0.25 mm thick; annealed in helium vapor at 450 C for 2.5 hrs; electrical resistivity reported as 5.56 and 27 μohm cm at 4.2 and 293 K, respectively; Lorenz function in the residual resistance region found to be 3.17 x $10^{-8}V^2K^{-2}$; data taken from smoothed curve.
2	256	-	1966	300			Predicted value-calculated from electrical resistivity value averaged from data of Spedding, F.H., et al. (Trans. AIME, 212, 379, 1958) and Curry, M.A., et al. (Phys. Rev., 117, 953, 1960), using the Lorenz number 3.36 x $10^{-8}V^2K^{-2}$ based on the smoothed curve of Lorenz number vs atomic number given by the authors.

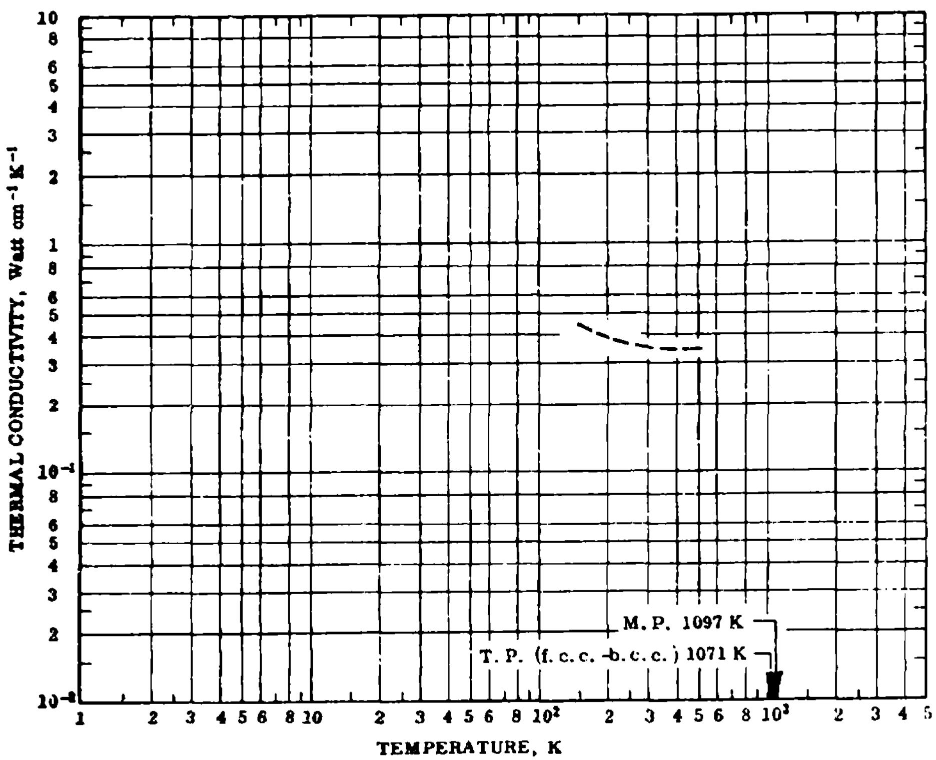
DATA TABLE NO. 66 THERMAL CONDUCTIVITY OF YTTERBIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		CURVE 1 (cont.)	
2.10	0.005	40.0	0.114
4.50	0.03	45.3	0.113
10.5	0.123	52.5	0.110
11.9	0.136	60.0	0.107
13.1	0.140	78.8	0.105
13.8	0.143		
15.0	0.143	CURVE 2	
16.3	0.142		
18.1	0.140	300	0.35
20.5	0.135		
23.8	0.130		
28.1	0.125		
31.9	0.120		
35.6	0.117		

FIGURE AND TABLE NO. 66R RECOMMENDED THERMAL CONDUCTIVITY OF YTTERBIUM



Recommended Values*

T_1	k_1	k_2	T_2
0	0	0	-459.7
150	(0.423)‡	(24.4)	-189.7
200	(0.384)	(22.2)	- 99.7
250	(0.361)	(20.9)	- 9.7
273.2	(0.354)	(20.5)	32.0
300	(0.349)	(20.2)	80.3
350	(0.345)	(19.9)	170.3
400	(0.341)	(19.7)	260.3
500	(0.337)	(19.5)	440.3

REMARKS

The recommended values are for high-purity ytterbium. The recommended values are obtained by estimation and their accuracy is uncertain.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$.   ‡ Values in parentheses are estimated.

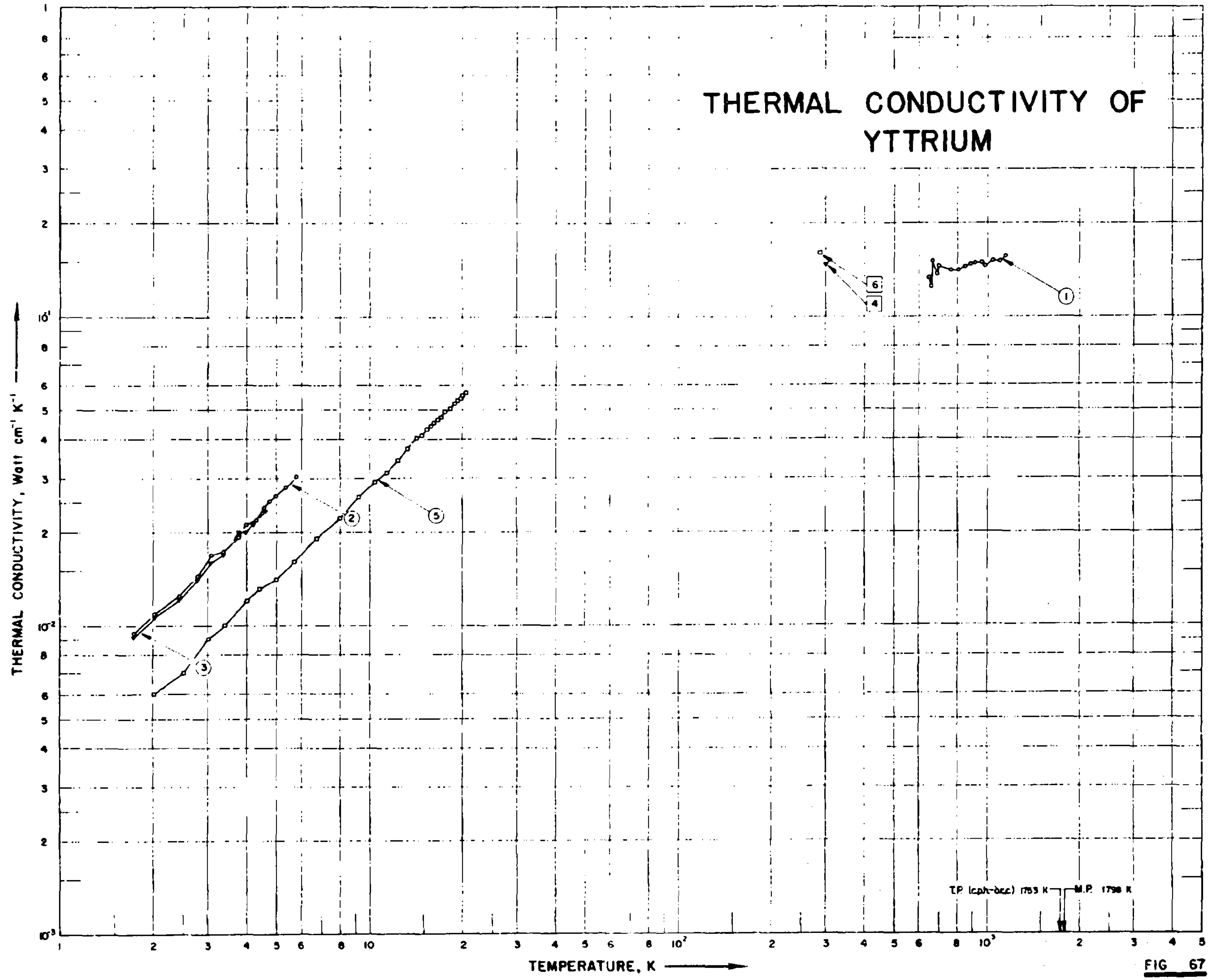

THERMAL CONDUCTIVITY OF YTTRIUM
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
T.P. (cph-bcc) 1753 K
M.P. 1798 K
1
2
3
4
5
6

FIG 67

SPECIFICATION TABLE NO. 67 THERMAL CONDUCTIVITY OF YTTRIUM

(Impurity 0.20% each; total impurities 0.50%)

[For Data Reported in Figure and Table No. 67]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	761		1959	653-1153	3-5		No details reported.
2	762	L	1965	1.8-5.9			99.99 nominal purity; polycrystalline; machined from zone-refined ingot; annealed at 1150 C for 75 hrs; residual electrical resistivity 5.10 μohm cm; electrical resistivity ratio $\rho(293\ K)/\rho(4.2\ K) = 13.0$; Lorenz number $L_0 = 2.65 \times 10^{-8}\ V^2\ K^{-2}$.
3	762	L	1965	1.8-4.7			The above specimen measured in a magnetic field of 6600 gauss.
4	811		1954	301.2	10		No details given.
5	817 897		1965	2.0-21			Approx 99.9 pure; flat specimen 0.25 mm thick; electrical resistivity 80 μ ohm cm at 293 K; electrical resistivity ratio $\rho(293\ K)/\rho(4.2\ K) = 7.3$; Lorenz number $3.00 \times 10^{-8}\ V^2K^{-2}$ at 4.2 K.
6	256	C	1966	291	± 4		~ 0.1 Ta, < 0.1 other rare earth metal, and ~ 0.03 other base metals; polycrystalline; specimen 0.63 cm in dia 0.63 cm long; electrical resistivity 53 μohm cm at 291 K; data derived by the authors from measurements by 2 different thermal comparators.

DATA TABLE NO. 67 THERMAL CONDUCTIVITY OF YTTRIUM

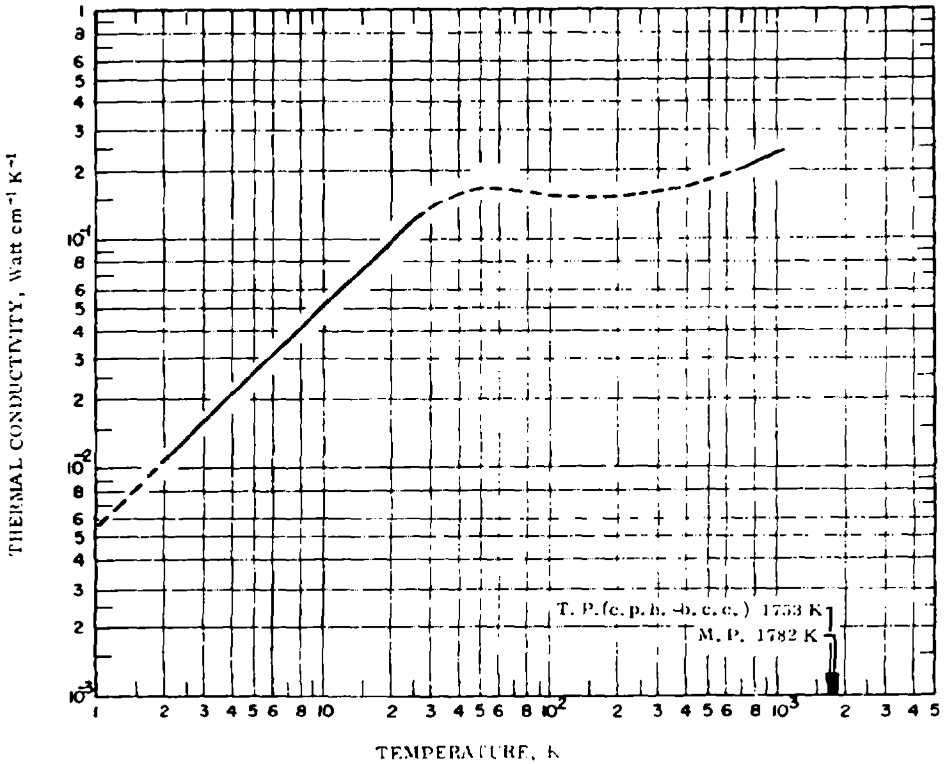
(Impurity<0.20%; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
652.6	0.134
652.6	0.131*
655.4	0.134*
663.7	0.125
674.8	0.151
697.1	0.137
705.4	0.145
774.8	0.141
785.9	0.142*
819.3	0.141
844.3	0.142*
860.9	0.145
891.5	0.147
891.5	0.148*
928.7	0.148
977.6	0.149
980.4	0.146*
997.1	0.146
1058.2	0.152
1063.7	0.152*
1072.1	0.150*
1083.2	0.152*
1088.7	0.150
1102.6	0.150
1135.9	0.151*
1152.6	0.156
CURVE 2	
1.75	0.0095
2.05	0.0110
2.45	0.0125
2.80	0.0145
3.10	0.0170
3.40	0.0175
3.80	0.0195
4.00	0.0213
4.35	0.0220
4.60	0.0243
4.80	0.0255
5.00	0.0265
5.40	0.0283
5.85	0.0305
CURVE 3	
1.75	0.0092
2.05	0.0107
2.45	0.0122
2.80	0.0140
3.10	0.0160
3.40	0.0170
3.80	0.0200
4.00	0.0200
4.25	0.0212
4.65	0.0235
CURVE 4	
301.2	0.146
CURVE 5	
2.0	0.006
2.5	0.007
3.0	0.009
3.4	0.010
4.0	0.012
4.4	0.013
5.0	0.014
5.7	0.016
6.7	0.019
8.0	0.022
9.2	0.026
10.4	0.029
11.4	0.031
12.4	0.034
13.3	0.037
14.2	0.040
14.8	0.041
15.4	0.043
15.7	0.044
16.1	0.045
16.6	0.046
17.0	0.047
17.5	0.049
18.2	0.050
18.8	0.052
19.2	0.053
CURVE 5 (cont.)	
19.7	0.054
20.0	0.055
20.5	0.056
CURVE 6	
291.0	0.159

* Not shown on plot

FIGURE AND TABLE NO 67R RECOMMENDED THERMAL CONDUCTIVITY OF YTTRIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	(0.180)	(10.4)	440.3
1	(0.00552)‡	(0.319)	-457.9	600	(0.192)	(11.1)	620.3
2	0.0108	0.624	-456.1	700	0.203	11.7	800.3
3	0.0159	0.919	-454.3	800	0.215	12.4	980.3
4	0.0210	1.21	-452.5	900	0.226	13.1	1160
5	0.0261	1.51	-450.7	1000	0.235	13.6	1340
6	0.0311	1.80	-448.9	1100	0.238	13.8	1520
7	0.0360	2.08	-447.1				
8	0.0410	2.37	-445.3				
9	0.0460	2.66	-443.5				
10	0.0510	2.95	-441.7				
11	0.0555	3.21	-439.9				
12	0.0603	3.48	-438.1				
13	0.0652	3.77	-436.3				
14	0.0698	4.03	-434.5				
15	0.0746	4.31	-432.7				
16	0.0792	4.58	-430.9				
18	0.0887	5.13	-427.3				
20	0.0982	5.67	-423.7				
25	(0.121)	(6.99)	-414.7				
30	(0.138)	(7.97)	-405.7				
35	(0.149)	(8.61)	-396.7				
40	(0.157)	(9.07)	-387.7				
45	(0.163)	(9.42)	-378.7				
50	(0.166)	(9.59)	-369.7				
60	(0.167)	(9.65)	-351.7				
70	(0.164)	(9.48)	-333.7				
80	(0.160)	(9.24)	-315.7				
90	(0.158)	(9.13)	-297.7				
100	(0.157)	(9.07)	-279.7				
150	(0.156)	(9.01)	-189.7				
200	(0.158)	(9.13)	- 99.7				
250	(0.160)	(9.24)	- 9.7				
273.2	(0.160)	(9.24)	32.0				
300	0.162	9.36	80.3				
350	(0.165)	(9.53)	170.3				
400	(0.169)	(9.76)	260.3				

REMARKS

The recommended values are for well-annealed 99.99⁺% pure yttrium with residual electrical resistivity $\rho_0 = 5.10\ \mu\Omega$ cm (characterication by ρ_0 becomes important below room temperature). The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

*T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu lb^{-1} ft^{-1} F^{-1}.

‡Values in parentheses are extrapolated or interpolated.

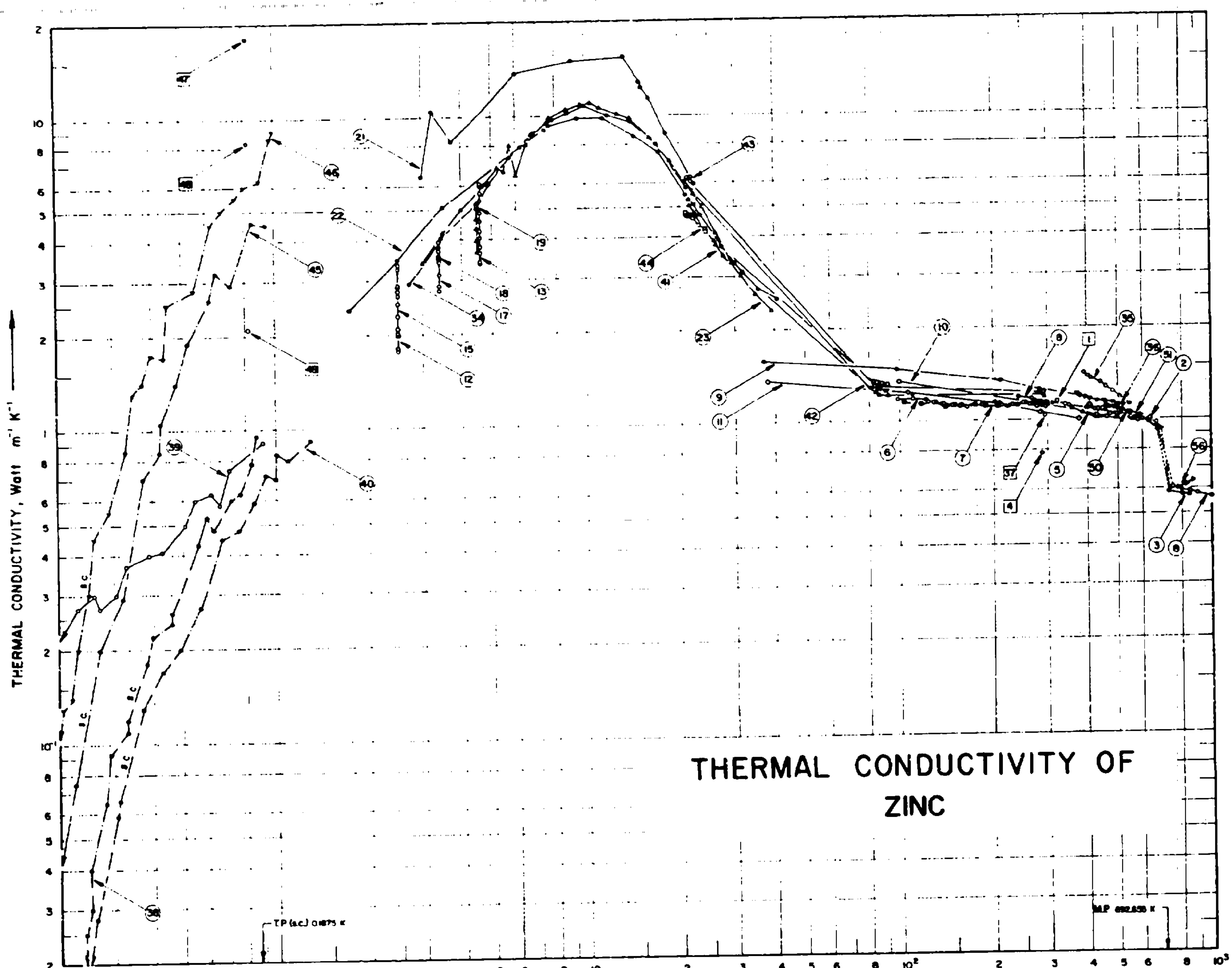

THERMAL CONDUCTIVITY OF ZINC
THERMAL CONDUCTIVITY, Watt m⁻¹ K⁻¹
TEMPERATURE, K
T.P (s.c) 0.875 K
M.P 692.655 K
s.c

FIG 68

SPECIFICATION TABLE NO. 68 THERMAL CONDUCTIVITY OF ZINC

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 68]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	230	L	1925	323			99.97 pure; Baker's analyzed metal; cylindrical specimen 10 cm long, 1.9 cm in dia; electrical conductivity at 22 C being 17.0×10^4 ohm^{-1} cm^{-1}.
2	6	L	1931	409-640			Pure redistilled zinc; cylindrical specimen of 0.585 cm dia; fracture crystalline with crystals radiating from axis of rod; density 7.10 g cm^{-3} at 21 C; the same specimen used by Lees in 1908 (curve 6).
3	95	L	1919	402-851			Measured in both solid and liquid states.
4	511	L	1918	288.4			Specimen radius 0.685 cm; furnished by the manufacturer Erba.
5	127	L	1925	361-562			99.8 pure; obtained from London Zinc Mills; cast from billets, rolled at 200 C, sawed into strips and drawn cold; density 7.13 g cm^{-3} at 21 C; electrical resistivity reported as 6.08, 8.09, 10.48, and 14.50 μohm cm at 35, 105, 200, and 350.2 C, respectively.
6	88	L	1908	99-297			Pure; turned from a cast stick of "pure redistilled zinc"; fracture crystalline with crystals radiating from the axis of rod; cylinder about 7 cm long and 0.585 cm in dia; density 7.1 g cm^{-3} at 21 C; electrical resistivity reported as 1.699, 1.96, 3.26, 3.69, 4.32, 5.36, 6.30, 6.99, 7.14, and 8.01 μohm cm at -180.3, -168.4, -116.3, -99.7, -70.1, -24.7, 16.7, 47.8, 54.3, and 90.3 C, respectively; first experiment.
7	88	L	1908	104-300			Second experiment of the above specimen.
8	13, 14	F	1939	243-1003			Specimens 4-5 cm in dia, 20-25 cm long used to find data in the solid state; for the liquid state molten zinc contained in a graphite cylinder to form a specimen 25 cm long and 4 cm in dia.
9	16	F	1929	37-382			99.993 Zn, 0.005 Fe, and 0.0018 Cd; single crystal; obtained from the Bureau of Standards; melted in an evacuated glass tube, lowered from the furnace at the rate of 1 cm h^{-1}; heat flow parallel to the basal plane.
10	16	F	1929	98-434		No. 2	Same compositions and supplier as the above specimen; polycrystalline; cast in vacuo in a graphite mold.
11	16	F	1929	38-380		No. 1	Similar to above but cast in open air.
12	342	L	1953	2.5		Zn 2	99.997 pure; single crystal; 1-2 mm dia x 5 cm long; obtained from Imperial Smelting Corp; specimen axis at 80° with the hexagonal axis; measured in transverse magnetic fields with strength H ranging from 0.17 to 3.73 kilooersteds.
13	342	L	1953	4.6		Zn 2	The above specimen measured in transverse magnetic fields with strength H ranging from 0.17 to 3.73 kilooersteds.
14	342	L	1953	4.6		Zn 2	The above specimen measured in longitudinal magnetic fields with strength H ranging from 0.17 to 3.73 kilooersteds.
15	342	L	1953	2.5		Zn 4	Similar to the above specimen but rod axis at 13° with the hexagonal axis; measured in transverse magnetic fields with strength ranging from 0.36 to 3.59 kilooersteds.
16	342	L	1953	2.5		Zn 4	The above specimen measured in longitudinal magnetic fields with strength ranging from 0.36 to 3.50 kilooersteds.

SPECIFICATION TABLE NO. 68 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
17	342	L	1953	3.4		Zn 4	The above specimen measured in transverse magnetic fields with strength ranging from 0.36 to 3.59 kilooersteds.
18	342	L	1953	3.4		Zn 4	The above specimen measured in longitudinal magnetic fields with strength ranging from 0.36 to 3.75 kilooersteds.
19	342	L	1953	4.5		Zn 4	The above specimen measured in transverse magnetic fields with strength ranging from 0.36 to 3.90 kilooersteds.
20	342	L	1953	4.5		Zn 4	The above specimen measured in longitudinal magnetic fields with strength ranging from 0.36 to 3.85 kilooersteds.
21	97	L	1952	3.0-23	2-3	Zn 1	99.9995 pure; polycrystalline; 1-2 mm dia x 5 cm long; provided by Hilger H. S. brand (HS 8392); annealed in evacuated quartz tube for several hrs at two-thirds the melting point.
22	97	L	1952	1.8-41	2-3	Zn 2	99.997 pure; single crystal; 1-2 mm dia x 5 cm long; provided by Imperial Smelting Corp; hexagonal axis at 80° to the specimen axis; annealed as the above specimen.
23	97	L	1952	3.0-40	2-3	Zn 3	Similar to the above specimen but hexagonal axis at 13° to the specimen axis.
24	280	L	1934	330.2	<0.8		99.99⁺ Zn, 0.0047 Pb, 0.0008 Cd, 0.0004 Fe, and 0.0002 Cu; unstrained single crystals; grown from a single 50 lb slab of "Evanwall" zinc; specimens 30 cm long, area of cross section 1.24 cm; measured on specimens having various orientations with values of $\cos^2\theta$ ranging from zero to 0.990 where θ is the angle between the normal to the basal cleavage plane and the axis of the rod.
25	280	L	1934	330.2	<0.8		Some of the above specimens strained by bending and straightening in both directions of the midpoint; measured with $\cos^2\theta$ ranging from zero to 0.51.
26	280	L	1934	330.2	<0.8		The above specimens annealed at 380 C for 11 hrs.
27	280	L	1934	330.2	<0.8		"Optically mosaic" crystals; two of the specimens grown from the same allotment of zinc as the above specimens; the other two ($\cos^2\theta$ = 0.93 and 0.935, respectively) grown from a different lot under different conditions; measured on the four specimens with $\cos^2\theta$ ranging from 0.13 to 0.935.
28	280	L	1934	330.2	<0.8		The second one of the above specimens strained by bending and straightening.
29	280	L	1934	330.2	<0.8		The first specimen ($\cos^2\theta$ = 0.13) and the above specimen annealed.
30	279	R	1951	331.4			Powdered; apparent density 2.454 g cm^{-3}.
31	279	R	1951	330.8			Powdered; apparent density 2.443 g cm^{-3}.
32	279	R	1951	331.0			Powdered; apparent density 2.465 g cm^{-3}.
33	279	R	1951	331.1			Powdered; apparent density 2.456 g cm^{-3}.
34	122	L	1955	2.7-21	3	Zn 4	99.997 pure; single crystal with hexagonal axis at 13° to rod axis; obtained from Imperial Smelting Corp; 2.75 cm x 0.0234 cm^2.

SPECIFICATION TABLE NO. 68 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
35	431	E	1944	394-550			Single crystal; electrical resistivity reported as 8.32, 8.88, 9.59, 10.10, 10.85, 11.53, and 12.66 μohm cm at 121.1, 143.9, 169.6, 188.4, 213.8, 238.9, and 277.1 C, respectively.
36	431	E	1944	371-529			Polycrystal; electrical resistivity reported as 8.22, 8.65, 9.09, 9.45, 10.19, 11.04, 11.85, 12.70, and 13.19 μohm cm at 97.9, 111.2, 123.9, 137.6, 159.4, 186.4, 213.6, 247.1, and 255.8 C, respectively.
37	504	P	1961	295.2	± 5		Pure; specimen size 1.9 x 1.16 x 0.282 cm; thermal conductivity value calculated from measured thermal diffusivity using data of specific heat and density taken from Smithsonian Physical Tables (9th ed., 1954).
38	409	L	1958	0.14-0.87	10	Zn 1	0.0001 impurity; single crystal; ~1.5 mm in dia and 100 mm long; specimen axis at an angle of 30 degrees to the [001] direction; measured in a magnetic field of 0.2 oersted; in superconducting state.
39	409	L	1958	0.18-0.91	10	Zn 1	The above specimen measured in a longitudinal magnetic field of 60 oersteds; in normal state.
40	409	L	1958	0.22-1.3	10	Zn 2	Similar to the above specimen but measured in a magnetic field of 0.2 oersted; in superconducting state.
41	294	L	1932	22-293		Zn 61	Single crystal; specimen 5.27 cm long, area of cross section 0.0552 cm^2; angle between specimen axis and hexagonal axis θ = 3.6°; electrical resistivity reported as 0.0674, 1.331, 5.69, and 6.16 μohm cm at -252, -190, 0, and 20 C, respectively.
42	294	L	1932	21-92		Zn 100	Single crystal; θ = 4.9°; electrical resistivity reported as 0.056, 1.333, 5.72, and 6.20 μohm cm at -252, -190, 0, and 20 C, respectively.
43	294	L	1932	21-293		Zn 72	Single crystal; specimen 6.13 cm long, area of cross section 0.0634 cm^2; θ = 8.7°; electrical resistivity reported as 0.0522, 1.3, 5.58, and 6.05 μohm cm at -252, -190, 0, and 20 C, respectively.
44	294	L	1932	21-296		Zn 101	Single crystal; specimen 4.94 cm long, area of cross section 0.0623 cm^2; θ = 79.7°; electrical resistivity reported as 0.0524, 1.179, 5.43, and 5.88 μohm cm at -252, -190, 0, and 20 C, respectively.
45	727, 291	L	1960	0.10-0.94		Zn 4	Single crystal; grown along the principal crystallographic direction by Kapitza's method; superconducting transition point 0.825 K; heat flow parallel to the hexagonal axis; in superconducting state.
46	727, 291	L	1960	0.10-1.09		Zn 7	Similar to above but heat flow perpendicular to the hexagonal axis; in superconducting state.
47	727, 291	L	1960	0.825		Zn 1	Similar to above.
48	727, 291	L	1960	0.825		Zn 2	Similar to above.
49	727, 291	L	1960	0.825		Zn 5	Similar to above but heat flow parallel to the hexagonal axis.

SPECIFICATION TABLE NO. 68 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
50	129	C	1933	462-553	5	Z. S.	99.9+ Zn, 0.04 Pb, and 0.02 Fe; 2 cm dia x 15 cm long; specimen prepared by re-melting commercially pure zinc and casting in graphite mold; lead used as comparative material (reference value taken from International Critical Table Vol. II: 0.352 Watt cm^{-1} C^{-1} at 0 C).
51	129	C	1933	313-596	5	Z. S.	Similar to the above specimen except commercial malleable nickel used as the indirect comparative material (based on the data of lead).
52	129	C	1933	342-602	5	Z. S.	Similar to that of the above specimen except zinc used as the indirect comparative material (based on the data of lead).
53	77	L	1900	291, 373		Zinc II	99.97 Zn (by difference), 0.01 Cd, 0.01 Fe, and 0.01 Pb; specimen 27 cm long and 1.805 cm in dia; density 7.11 g cm^{-3}; electrical conductivity reported as 16.51 and 12.59 x 10^4 ohm^{-1} cm^{-1} at 18 and 100 C, respectively.
54	77	L	1900	291, 373		Zinc II, wire	Similar to the above specimen but electrical conductivity reported as 15.98 and 12.42 x 10^4 ohm^{-1} cm^{-1} at 18 and 100 C, respectively.
55	734	R	1926	323, 673			Specimen in the form of a hollow cylinder.
56	838	C	1966	576-874			Molten specimen placed in a hole 21 mm in dia drilled in an asbestos cement cylinder of 30 mm height; 1Kh18N9T steel used as comparative material.
57	850	L	1929	83-476			Prepared by melting pure zinc supplied by Firma Kahlbaum in a quartz tube, then quickly solidified in cool water; electrical resistivity reported as 1.658, 5.663, 7.837, and 10.36 μohm cm at 83.2, 273, 374, and 476 K, respectively.

DATA TABLE NO. 68 THERMAL CONDUCTIVITY OF ZINC

(Impurity < 0.20% each; total impurities <0.50%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
323	1.159
CURVE 2	
409.2	1.109
426.2	1.075*
436.2	1.071
449.2	1.075
479.2	1.042
552.2	1.021*
555.2	1.008*
586.2	0.992
640.2	0.996
CURVE 3	
402.2	1.096
515.2	1.046
553.2	1.029
586.2	1.008
635.2	0.975
673.2	0.920
733.2	0.586
810.2	0.577
851.2	0.573
CURVE 4	
288.4	0.785
CURVE 5	
360.8	1.08
390.8	1.06
433.5	1.03
499.1	1.01
562.0	0.996
CURVE 6	
99.2	1.18
112.2	1.18
123.2	1.17

T	k
CURVE 6 (cont.)	
129.2	1.15
139.2	1.14
149.2	1.13
158.2	1.12
166.2	1.11
186.2	1.13
204.2	1.15
214.2	1.13
234.2	1.13
251.2	1.14
264.2	1.13
277.2	1.11
288.2	1.12
296.2	1.11
297.2	1.10
CURVE 7	
104.2	1.15
118.2	1.14
131.2	1.15
141.2	1.11
150.2	1.13
159.2	1.12
176.2	1.13
190.2	1.12
208.2	1.12
224.2	1.11
240.2	1.12
254.2	1.14
266.2	1.13
277.2	1.14
284.2	1.14
293.2	1.13
297.2	1.11
300.2	1.12
CURVE 8	
243.2	1.19
268.2	1.17
343.2	1.12
353.2	1.11

T	k
CURVE 8 (cont.)	
428.2	1.07
608.2	0.996
673.2	0.975
758.2	0.607
803.2	0.594
858.2	0.586
908.2	0.577
1003.2	0.565
CURVE 9	
37.2	1.57
99.2	1.47
213.2	1.35
283.2	1.26
381.2	1.19
CURVE 10	
98.2	1.34
279.2	1.12
365.2	1.08
390.2	1.06
434.2	1.03
CURVE 11	
38.2	1.36
108.2	1.24
213.2	1.12
283.2	1.06
380.2	1.00
H	**k**
CURVE 12 (T = 2.5 K)	
(kilooersteds)	
0.17	3.47*
0.35	3.37
0.55	3.26
1.08	2.88
1.41	2.66

H	k
CURVE 12 (cont.) (T = 2.5 K)	
(kilooersteds)	
2.15	2.28*
2.86	2.02
3.57	1.81
3.73	1.77
CURVE 13 (T = 4.6 K)	
0.17	6.06
0.35	5.99
0.70	5.65
1.08	5.35
1.41	4.88
1.79	4.57
2.15	4.25
2.50	4.03
2.86	3.79
3.22	3.61
3.57	3.41
3.73	3.36
CURVE 14* (T = 4.6 K)	
0.17	6.17
0.35	6.10
0.70	5.99
1.41	5.49
2.15	5.13
2.86	4.74
3.73	4.48
CURVE 15 (T = 2.5 K)	
0.36	2.85
1.08	2.74
1.80	2.50
2.52	2.29
3.22	2.09
3.59	1.99

H	k
CURVE 16* (T = 2.5 K)	
(kilooersteds)	
0.36	2.86
1.08	2.77
1.80	2.69
2.52	2.60
3.22	2.58
3.50	2.51
CURVE 17 (T = 3.4 K)	
0.36	3.92
1.08	3.69
1.80	3.41
2.52	3.11
3.22	2.86
3.59	2.75
CURVE 18 (T = 3.4 K)	
0.36	4.05*
1.08	3.92*
1.80	3.77
2.52	3.68*
3.22	3.55
3.75	3.48
CURVE 19 (T = 4.5 K)	
0.36	5.24
0.75	5.18
1.08	5.05
1.80	4.67
2.52	4.31
3.22	3.95
3.90	3.66

H	k
CURVE 20* (T = 4.5 K)	
(kilooersteds)	
0.36	5.38
1.08	5.35
1.80	5.21
2.52	4.88
3.22	4.81
3.85	4.72
T	**K**
CURVE 21	
3.0	6.4
3.25	10.5
3.75	8.3
6.00	13.7
9.25	15.0
13.5	15.4
15.3	12.6
15.3	12.2
16.3	11.4
18.3	8.7
22.5	5.9
CURVE 22	
1.75	2.4
2.5	3.5
3.5	5.1
4.75	6.1
6.25	7.9
7.75	9.3
9.5	9.8
11.5	9.6
14.5	8.5
17.25	7.5
21.0	5.5
21.5	5.3
22.5	5.1
23.5	4.7
27.5	3.7
30.0	3.3

T	k
CURVE 22 (cont.)	
32.0	3.1
35.8	2.7
41.0	2.5
CURVE 23	
3.0	3.4
3.5	4.2
4.0	5.0
4.75	6.0
5.25	6.8
5.5	6.6
5.75	7.4
5.75	8.0
6.0	6.4
6.5	8.0
6.75	8.7
7.75	9.9
8.75	10.6
9.75	10.9
10.5	11.0
11.3	10.6
12.8	10.1
14.0	9.8
16.3	8.4
18.8	7.0
22.3	5.5
23.8	5.0
26.3	4.1
29.5	3.3
31.5	3.0
35.0	2.6
39.5	2.3
$\cos^2\theta$	**k**
CURVE 24* (T = 330.2 K)	
0	1.07
0.005	1.06
0.02	1.07
0.025	1.05
0.175	1.06

$\cos^2\theta$	k
CURVE 24* (cont.) (T = 330.2 K)	
0.26	1.05
0.34	1.04
0.515	1.04
0.715	1.03
0.815	1.02
0.990	1.01
CURVE 25* (T = 330.2 K)	
0	1.04
0.26	1.02
0.51	1.01
CURVE 26* (T = 330.2 K)	
0	1.06
0.51	1.03
1.00	0.99
CURVE 27* (T = 330.2 K)	
0.13	1.06
0.91	1.01
0.93	1.05
0.935	1.05
CURVE 28* (T = 330.2 K)	
0.91	1.00
CURVE 29* (T = 330.2 K)	
0.13	1.04
0.91	1.00

* Not shown on plot

DATA TABLE NO. 68 (continued)

T	k
CURVE 30*	
331.4	0.00436
CURVE 31*	
330.8	0.00412
CURVE 32*	
331.0	0.00502
CURVE 33*	
331.1	0.00483
CURVE 34	
2.72	2.91
3.46	4.07
4.58	5.28
4.92	6.07
5.76	7.39
6.84	8.78
7.42	8.98
7.90	9.72
8.84	10.20
10.0	10.80
11.9	10.00
14.1	9.53
17.0	7.97
21.2	5.80
CURVE 35	
394.2	1.41
406.0	1.38
417.0	1.36
442.7	1.32
461.5	1.28
486.9	1.23
512.0	1.18
550.2	1.12
CURVE 36	
371.0	1.21
384.3	1.20
397.0	1.18

T	k
CURVE 36 (cont.)	
410.7	1.17
432.5	1.15
459.5	1.15
486.7	1.13
552 ~~510.2~~	1.11
528.9	1.11
CURVE 37	
295.2	1.046
CURVE 38	
0.135	0.0013*
0.14	0.0016*
0.15	0.0022*
0.16	0.0039*
0.18	0.0094*
0.19	0.013*
0.21	0.013*
0.22	0.016*
0.24	0.020*
0.24	0.025
0.25	0.030
0.25	0.040
0.28	0.065
0.29	0.093
0.33	0.11
0.33	0.12
0.38	0.18
0.40	0.22
0.46	0.24
0.46	0.26
0.56	0.43
0.60	0.53
0.63	0.48
0.72	0.60
0.77	0.73
0.84	0.88
0.87	0.95
CURVE 39	
0.18	0.18*
0.23	0.27
0.26	0.30
0.27	0.27

T	k
CURVE 39 (cont.)	
0.305	0.30
0.33	0.37
0.39	0.40
0.43	0.41
0.51	0.50
0.55	0.60
0.62	0.63
0.66	0.58
0.71	0.75
0.91	0.91
CURVE 40	
0.22	0.016*
0.23	0.013*
0.26	0.028
0.305	0.059
0.31	0.066
0.37	0.13
0.43	0.17
0.49	0.20
0.57	0.27
0.67	0.45
0.76	0.48
0.85	0.59
0.93	0.72
1.00	0.70
1.03	0.84
1.10	0.80
1.30	0.92
CURVE 41	
21.6	5.04
22.5	4.80
22.6	4.68
25.9	3.86
26.2	3.76
27.7	3.49
84.7	1.25
86.8	1.236
92.6	1.229
291.3	1.206
292.5	1.196

T	k
CURVE 42	
21.0	6.04
21.0	6.02*
21.4	6.04*
22.0	5.70
80.2	1.289
82.8	1.275
85.8	1.271
87.4	1.277
90.9	1.264
91.7	1.261
CURVE 43	
21.3	6.22
21.8	6.25
21.9	6.03
84.0	1.306
292.5	1.231
292.8	1.248
CURVE 44	
21.0	4.80
21.0	4.77
21.3	4.69
21.7	4.68
21.9	4.64
22.1	4.66
22.2	4.59
23.2	4.38
24.2	4.21
24.4	4.14
83.5	1.35
85.4	1.345
88.4	1.339
92.0	1.324*
293.1	1.249*
295.2	1.230*
296.1	1.234*
CURVE 45	
0.100	0.00055*
0.110	0.00100*
0.115	0.00110*
0.120	0.00170*
0.125	0.00325*

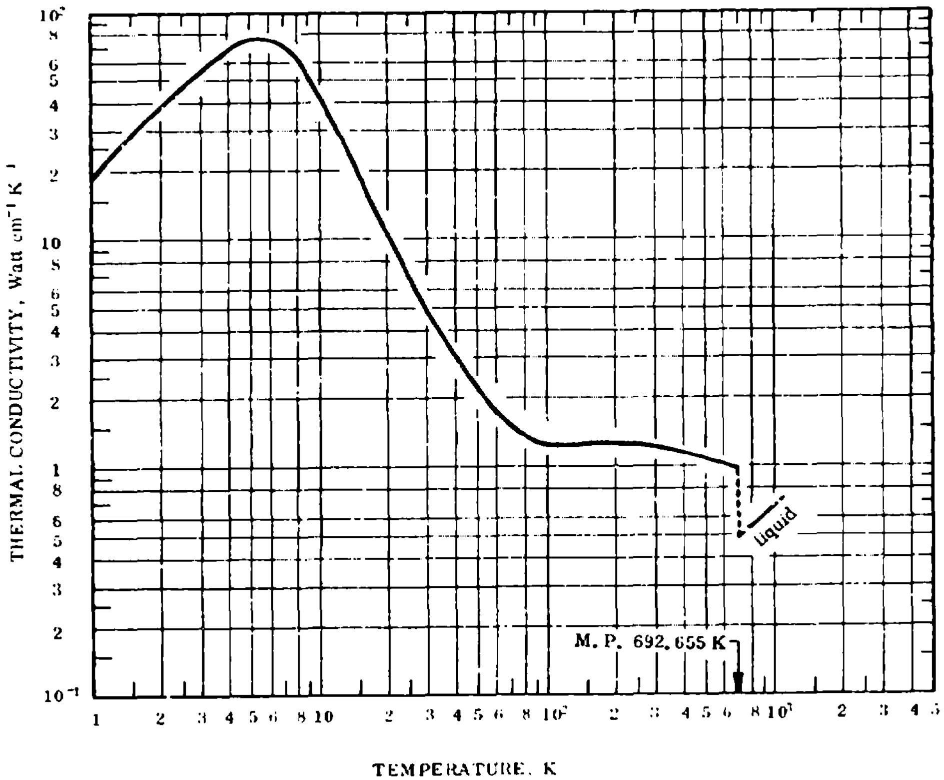
T	k
CURVE 45 (cont.)	
0.132	0.00475*
0.140	0.00750*
0.170	0.0180*
0.225	0.0750
0.270	0.2000
0.320	0.290
0.375	0.700
0.425	0.850
0.430	1.050
0.480	1.400
0.525	1.900
0.620	2.600
0.650	3.200
0.725	2.900
0.850	4.600
0.940	4.500
CURVE 46	
0.100	0.005*
0.115	0.006*
0.115	0.008*
0.120	0.010*
0.130	0.015*
0.140	0.025*
0.145	0.033*
0.170	0.050*
0.175	0.070*
0.185	0.075*
0.185	0.085*
0.200	0.100*
0.205	0.130
0.220	0.140
0.230	0.200
0.250	0.300
0.260	0.450
0.290	0.650
0.330	0.850
0.350	1.250
0.375	1.400
0.400	1.750
0.440	1.700
0.450	2.500
0.550	2.800
0.625	4.500
0.675	5.000
0.750	5.500

T	k
CURVE 46 (cont.)	
0.800	6.000
0.900	6.200
0.975	8.500
1.000	9.000
CURVE 47	
0.825	18.0
CURVE 48	
0.825	8.3
CURVE 49	
0.825	2.1
CURVE 50	
462.2	1.106
493.2	1.097
523.2	1.065
553.2	1.039
CURVE 51	
513.2	1.138
463.2	1.087
508.2	1.071
552.2	1.050
596.2	1.027
CURVE 52*	
342.2	1.138
358.2	1.130
398.2	1.123
430.2	1.096
438.2	1.096
467.2	1.097
492.2	1.078
504.2	1.080
544.2	1.059
602.2	1.029

T	k
CURVE 53*	
291.2	1.11
373.2	1.096
CURVE 54*	
291.2	1.07
373.2	1.08
CURVE 55*	
323.2	1.11
673.2	0.900
CURVE 56	
576.2	0.9938*
618.2	0.9671*
667.2	0.9420
692.2	0.9252
713.2	0.5861*
734.2	0.5903
786.2	0.5987
832.2	0.6154
874.2	0.6322
CURVE 57*	
83.2	1.256
273	1.252
374	1.248
476	1.239

* Not shown on plot

FIGURE AND TABLE NO. 68H RECOMMENDED THERMAL CONDUCTIVITY OF ZINC



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	19.0	1100	-457.9
2	37.9	2190	-456.1
3	55.5	3210	-454.3
4	69.7	4030	-452.5
5	77.8	4500	-450.7
6	78.0	4510	-448.9
7	71.7	4140	-447.1
8	61.8	3570	-445.3
9	51.9	3000	-443.5
10	43.2	2500	-441.7
11	36.4	2100	-439.9
12	30.8	1780	-438.1
13	26.1	1510	-436.3
14	22.4	1290	-434.5
15	19.4	1120	-432.7
16	16.9	976	-430.9
18	13.3	768	-427.3
20	10.7	618	-423.7
25	6.[illegible]	399	-414.7
30	[illegible]	[illegible]	-405.7
35	[illegible]	[illegible]	-396.7
40	2.[illegible]	172	-387.7
45	2.48	143	-378.7
50	2.1[illegible]	[illegible]	-369.7
60	1.71	98.8	-351.7
70	1.48	85.5	-333.7
80	1.35	79.7	-315.7
90	1.27	77.4	-297.7
100	1.24	76.3	-279.7
150	1.22	74.0	-189.7
200	1.23	72.8	- 99.7
250	1.22	71.6	- 9.7
273.2	1.22	70.5	32.0
300	1.21	69.9	80.3
350	1.18	68.2	170.3
400	1.16	67.0	260.3

T_1	k_1	k_2	T_2
500	1.11	64.1	440.3
600	1.05	60.7	620.3
692.655	1.00	57.8	787.091
In Liquid State			
692.655	(0.495)‡	(28.6)	787.091
700	(0.459)	(28.8)	800.3
800	0.557	32.2	980.3
900	0.615	35.5	1160
1000	0.673	38.9	1340
1100	(0.730)	(42.2)	1520

REMARKS

The recommended values are for well-annealed 99.999$^+$% pure zinc with residual electrical resistivity ρ_0 = 0.00128 $\mu\Omega$ cm (characterization by ρ_0 becomes important at temperatures below about 150 K). The values below 1.5 T_m are calculated to fit experimental data by using n = 3.00, α' = 1.83 x 10^{-4}, and β = 0.0525. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 3% of the true values near room temperature and 3 to 10% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated.

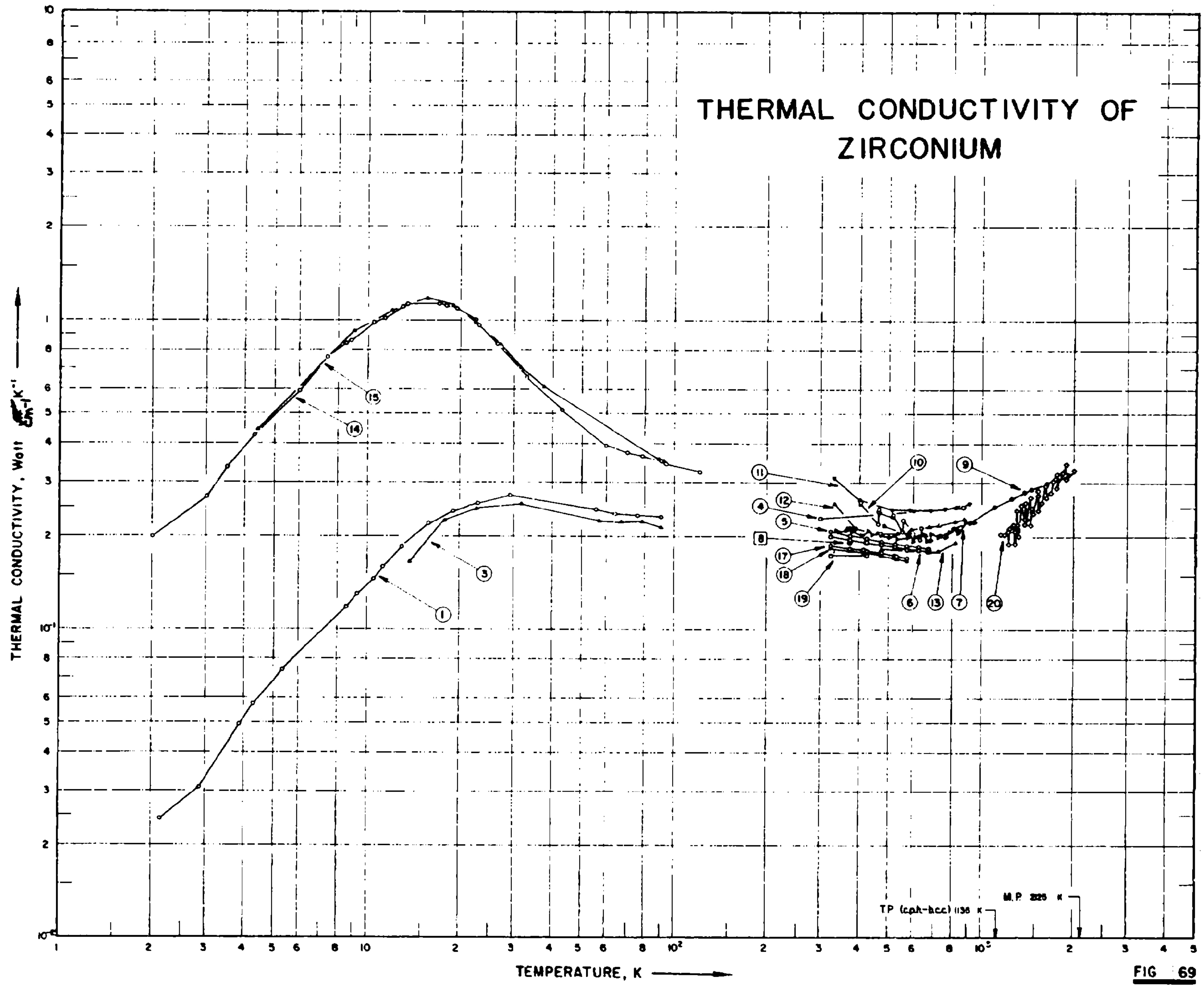

THERMAL CONDUCTIVITY OF ZIRCONIUM
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
TP (cph-bcc) 1136 K
M.P. 2125 K
1
3
4
5
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FIG 69

SPECIFICATION TABLE NO. 69 THERMAL CONDUCTIVITY OF ZIRCONIUM

(Impurity < 0.20% each; total impurities < 0.50%)

[For Data Reported in Figure and Table No. 69]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	83	L	1956	2.2-91		Zr 1a	99.99 Zr; spectroanalysis shows Fe (all sensitive lines), Hf and Ni (all sensitive lines faintly), Si and Ti (some sensitive lines), and Al, Cr, Cu, and Mg (faintly visible); JM5000 from Johnson, Matthey and Co.; 3 mm dia rod annealed at 950 C for 5 hrs in vacuum; electrical resistivity 48 μohm cm at 293 K, residual electrical resistivity 1.98 μohm cm; mounted in the cryostat with a push fit into copper fitting; measured with the current lead (for the measurements of electrical resistivity) attached.
2	83	L	1956	3.3-90		Zr 1b	The above specimen measured with the current lead removed.
3	83	L	1956	14-90		Zr 1c	The above specimen unintentionally strained by drilling and tapping to insert the connectors for re-mounting.
4	292	P	1954	298, 873			Preliminary results.
5	27	C	1953	323-673		2682 A	Pure; 2 cm dia x 15 cm long; arc-melted from WAPD grade 1 crystal bar; Armco iron used as comparative material; data taken from smoothed curve.
6	27	C	1953	323-673		498	Pure; 2 cm dia x 15 cm long; arc-melted from Bureau of Mines sponge Zr; Armco iron used as comparative material; data taken from smoothed curve.
7	101	L	1955	336-950	2.0		Nominally pure; cylindrical specimen 7.938 in long, 0.787 in. in dia; obtained from Westinghouse; prepared from Foote Grade 1 crystal bar ingot; the ingot melted in tungsten arc furnace, forged at 845 C in argon to the size 10 x 1 x 1 in., annealed in vacuum for 0.5 hr at 1000 C; machined to final shape.
8	555	C	1956	373.2			Hafnium-containing crystal bar.
9	614	R	1961	484-1925	5		99.95 Zr, 0.029 Fe, 0.017 C, 0.0045 Hf, and <0.031 other elements; specimen consisted of 5 one-in. dia disks; density 6.49 g cm^{-3}.
10	194	L	1951	402-639	±5.0	D-151	Assumed to be pure; 0.626 in. dia crystal bar; lot No. D-151; obtained from Argonne National Laboratory.
11	441		1957	331-917		Iodide Zirconium	99.9 pure; annealed in vacuum for 8 hrs at 700 C; electrical resistivity at 58.0, 124.1, 239.8, 321.0, 415.6, 490.6, 558.8, and 644.0 C being respectively, 36.1, 47.6, 66.6, 75.8, 87.0, 94.4, 100.0, and 106 μohm cm; Lorenz number reported at these temperatures were 3.38, 3.33, 3.18, 3.11, 3.08, 3.04, 3.03, and 2.92 x 10^{-8} V^2K^{-2}, respectively.
12	441		1957	332-879			99.78 Zr, 0.14 Hf, and 0.08 C; electrical resistivity reported as 53.76, 64.93, 78.74, 87.71, 95.25, 105.26, 111.11, 120.48, and 125.00 μohm cm at 59.0, 117.0, 202.0, 262.0, 318.0, 402.0, 456.0, 548.0, and 606.0 C, respectively; Lorenz numbers reported at these temperatures were 3.46, 3.44, 3.54, 3.36, 3.37, 3.34, 3.37, 3.28 and 3.29 x 10^{-8} V^2K^{-2}, respectively.

SPECIFICATION TABLE NO. 69 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
13	295	L,R,C	1952	473-823			Pure; 98-100% of theoretical density.
14	401	L	1959	2.0-121		Zr 4	99.95 Zr, 0.0132 Hf, < 0.0100 each of P and Zn, 0.0079 C, 0.0021-0.0050 O, 0.0003-0.0050 N, 0.0024 Fe, 0.0011 Ni, 0.0002-0.0007 each of Ca, Cr, H, Mo, and Si, and < 0.0010 other elements; arc cast, annealed at 1100 C for 4 hrs, swaged at room temperature, annealed at 1000 C for 15 min and at 800 C in a vacuum of $1\text{-}2\times10^{-6}$ mm Hg for 15 min, cut to four lengths and clamped together.
15	401	L	1959	4.4-89		Zr 4a	The above specimen unclamped and retightened.
16	442	C	1951	323-573	± 3.0	Zr 1	0.04 Hf, 0.04 Fe, 0.02 Ni, 0.007 Ti, 0.001 Al, and 0.001 Sn; Westinghouse ingot D-216 forged at 950 C, and machined; electrical resistivity reported as 44.1 and 81.3 μohm cm at 298 and 533 K, respectively.
17	442	C	1951	323-573	± 3.0	SA 1568; Zr 7	0.1 Fe, 0.07 Ta, 0.07 C, 0.02 Al, 0.007 Ti, and 0.0055 N; obtained from ANL; annealed; electrical resistivity reported as 50.5, 68.2, and 85.1 μohm cm at 298, 415, and 533 K, respectively.
18	442	C	1951	323-573	± 3.0	SA 1576; Zr 8	0.16 Ta, 0.10 Fe, 0.06 Al, 0.02 C, 0.015 N, and 0.005 Ti; obtained from ANL; electrical resistivity reported as 52.4, 70.1, and 86.6 μohm cm at 298, 415, and 533 K, respectively.
19	715	L, C	1961	323, 423	± 5	050	99.827 Zr (by difference), 0.110, 0.045 Fe, 0.01 C, and 0.008 N; as-extruded rod 10 cm long, 1.27 cm in dia; arc-melted; electrical resistivity reported as 59.5 and 75 μohm cm at 323 and 423 K, respectively; Armco iron used as comparative material; energy flow also measured calorimetrically.
20	741	L	1965	1160-2000		Iodide Zirconium	99.5⁺ pure; 14 mm dia x 65 mm long; vacuum annealed; density 6.45 g cm^{-3} at room temperature.
21	843	-	1966	298.2			Powder specimen contained in a 0.75 in. dia x 2 in. long cylindrical cell; average grain size 36.9μ; thermal conductivity measured by using the transient line source method, measured in nitrogen at limiting high pressure.
22	843	-	1966	298.2			Similar to above except average grain size 48.0μ.
23	843	-	1966	298.2			Similar to above except average grain size 57.5μ.
24	843	-	1966	298.2			Similar to above except average grain size 67.8μ.
25	843	-	1966	298.2			Similar to above except average grain size 84.5μ.
26	843	-	1966	298.2			Similar to above except average grain size 95.3μ.
27	843	-	1966	298.2			Similar to above except average grain size 137μ.
28	843	-	1966	298.2			Similar to above except average grain size 164μ.
29	843	-	1966	298.2			Similar to above except average grain size 199μ.

SPECIFICATION TABLE NO. 69 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
30	843	-	1966	298.2			Similar to above except average grain size 228μ.
31	843	-	1966	298.2			Similar to above except average grain size 318μ.
32	843	-	1966	298.2			Similar to above; mesh size-70 + 80; measured in nitrogen at 1 atm.
33	843	-	1966	298.2			Similar to above; mesh size -70 +80; measured in nitrogen under pressure in the range $1.06 \times 10^{-2} \sim 5.89 \times 10^{3}$ mm Hg.
34	843	-	1966	298.2			Similar to above; measured in helium under pressure in the range $1.00 \times 10^{-2} \sim 3.467 \times 10^{3}$ mm Hg.
35	843	-	1966	298.2			Similar to above; measured in argon under pressure in the range $1.00 \times 10^{-2} \sim 4.786 \times 10^{3}$ mm Hg.

DATA TABLE NO. 69 THERMAL CONDUCTIVITY OF ZIRCONIUM

[Temperature, T, K; Thermal Conductivity, k, Watt cm⁻¹K⁻¹]

T	k
CURVE 1	
2.15	0.0244
2.87	0.0309
3.87	0.0493
4.30	0.0573
5.34	0.0745
6.60	0.119
9.31	0.131
10.60	0.147
11.32	0.161
13.00	0.186
15.91	0.221
19.06	0.243
22.93	0.258
29.38	0.274
55.90	0.246
64.20	0.238
76.00	0.235
90.56	0.233
CURVE 2*	
3.3	0.038
4.3	0.052
16.4	0.211
20.7	0.248
59.7	0.244
89.6	0.234
CURVE 3	
13.76	0.167
17.77	0.226
22.64	0.248
31.81	0.256
56.88	0.225
67.10	0.223
78.23	0.225
90.40	0.215
CURVE 4	
298.2	0.23
873.2	0.25

T	k
CURVE 5	
323.2	0.209
373.2	0.202
423.2	0.198
473.2	0.194
523.2	0.190
573.2	0.188
623.2	0.186
673.2	0.184
CURVE 6	
323.2	0.201
373.2	0.196
423.2	0.192
473.2	0.189
523.2	0.186
573.2	0.184
623.2	0.182
673.2	0.181
CURVE 7	
335.7	0.211
343.2	0.208
363.2	0.210
367.2	0.214
375.2	0.214
378.2	0.209
383.2	0.209
407.2	0.202
428.2	0.210
440.2	0.204
460.2	0.206
469.2	0.203
473.2	0.203*
478.2	0.205*
500.2	0.199
521.2	0.203
523.2	0.198*
533.2	0.197
533.2	0.206*
575.2	0.199
583.2	0.206
598.2	0.194
605.2	0.199

T	k
CURVE 7 (cont.)	
615.2	0.200*
651.2	0.204
665.2	0.194
685.2	0.195
685.2	0.205
728.2	0.200
743.2	0.202*
758.2	0.200
786.2	0.208
833.2	0.213
838.2	0.204
865.2	0.224
950.2	0.224
CURVE 8	
373.2	0.192
CURVE 9	
483.7	0.218
572.6	0.206
625.4	0.202
734.8	0.202
812.1	0.215
917.1	0.224
1112.1	0.253
1255.4	0.268
1387.6	0.283
1457.1	0.287
1647.6	0.301
1782.6	0.308
1925.4	0.319
CURVE 10	
401.5	0.256
402.1	0.260
460.4	0.220
461.5	0.242
462.1	0.247
462.7	0.241
515.4	0.232
516.6	0.237
552.1	0.208

T	k
CURVE 10 (cont.)	
555.4	0.228
533.8	0.197
638.8	0.215
CURVE 11	
331.2	0.311
397.3	0.266
513.0	0.246
594.2	0.246
688.8	0.245
763.8	0.247
832.0	0.252
917.2	0.257
CURVE 12	
332.2	0.257
390.2	0.214
475.2	0.205
535.2	0.206
591.2	0.211
675.2	0.216
729.2	0.219
821.2	0.225
879.2	0.233
CURVE 13	
473.2	0.184
673.2	0.180
723.2	0.180
823.2	0.192
CURVE 14	
2.0	0.200
3.0	0.270
3.5	0.335
4.3	0.426
6.0	0.595
7.5	0.660
8.5	0.845
8.8	0.865
10.5	0.987

T	k
CURVE 14 (cont.)	
11.3	1.02
13.0	1.11
13.5	1.13
17.0	1.14
18.0	1.12
19.5	1.10
22.5	1.01
23.0	0.970
26.3	0.845
33.0	0.655
43.0	0.515
59.7	0.395
70.0	0.375
78.5	0.365
90.3	0.350
91.6	0.350
93.5	0.345
121.0	0.325
CURVE 15	
4.4	0.445
9.0	0.930
12.0	1.08
15.6	1.18
19.0	1.12
22.5	0.990
27.0	0.835
31.6	0.705
37.5	0.615
89.0	0.355
CURVE 16*	
323.2	0.209
373.2	0.204
415.2	0.200
423.2	0.200
473.2	0.196
523.2	0.192
533.2	0.191
573.2	0.187

T	k
CURVE 17	
323.2	0.188
373.2	0.184
415.2	0.182
423.2	0.181
473.2	0.178
523.2	0.175
533.2	0.174
573.2	0.171
CURVE 18	
323.2	0.184
373.2	0.181
415.2	0.178
423.2	0.178
473.2	0.175
523.2	0.172
533.2	0.171
573.2	0.168
CURVE 19	
323.2	0.175
423.2	0.175
CURVE 20	
1160	0.205
1190	0.205
1225	0.208
1230	0.190
1235	0.215
1275	0.220
1280	0.208
1280	0.190
1310	0.245
1320	0.220
1330	0.200
1350	0.255
1390	0.230
1390	0.220
1395	0.260
1400	0.230
1450	0.270
1450	0.220
1460	0.250

T	k
CURVE 20 (cont.)	
1480	0.240
1525	0.285
1540	0.275
1540	0.245
1575	0.260
1620	0.295
1635	0.295*
1635	0.270
1680	0.280
1715	0.305
1760	0.320
1760	0.290
1845	0.325
1895	0.345*
1895	0.310
2000	0.330*
CURVE 21*	
298.2	0.00272
CURVE 22*	
298.2	0.00278
CURVE 23*	
298.2	0.00279
CURVE 24*	
298.2	0.00279
CURVE 25*	
298.2	0.00330
CURVE 26*	
298.2	0.00334
CURVE 27*	
298.2	0.00338

T	k
CURVE 28*	
298.2	0.00372
CURVE 29*	
298.2	0.00397
CURVE 30*	
298.2	0.00365
CURVE 31*	
298.2	0.00360
CURVE 32*	
298.2	0.00314
p(mm Hg)	**k**
CURVE 33* T = 298.2	
0.0106	0.0000494
4.32	0.000669
110	0.00181
741	0.00318
2818	0.00356
3890	0.00356
CURVE 34* T = 298.2	
0.0100	0.0000510
0.692	0.000196
1.78	0.000390
19.7	0.00181
129	0.00552
724	0.00854
2818	0.0111
3467	0.0111

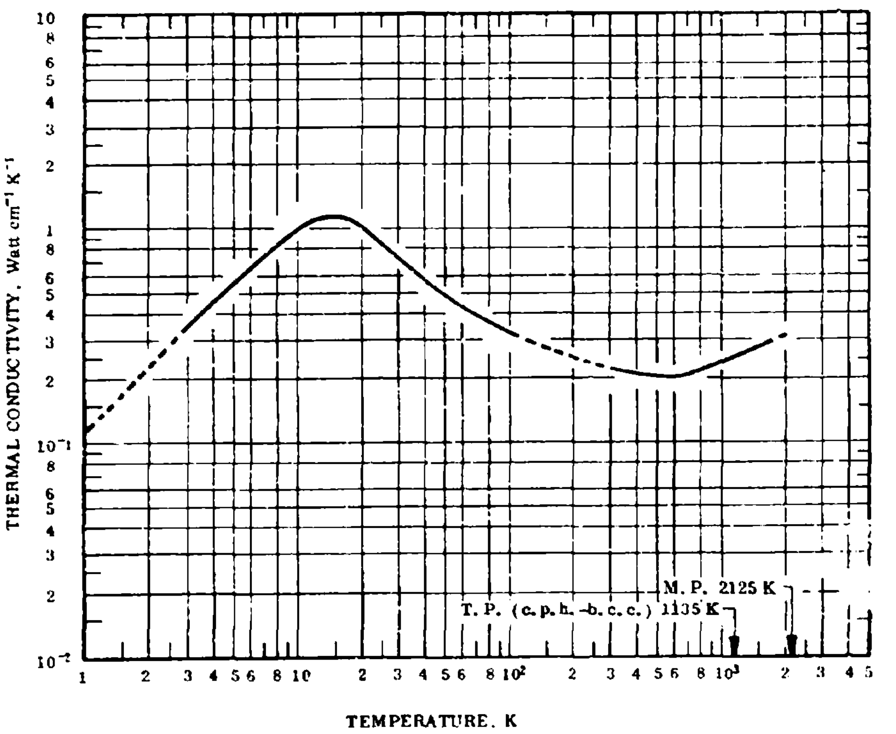
*Not shown on plot

DATA TABLE NO. 69 (continued)

p(mm Hg)	k
CURVE 35*	
T = 298.?	
0.0100	0.0000469
1.36	0.000293
11.0	0.000787
135	0.00187
724	0.00230
2818	0.00264
4786	0.00264

*Not shown on plot

FIGURE AND TABLE NO. 69R RECOMMENDED THERMAL CONDUCTIVITY OF ZIRCONIUM



RECOMMENDED VALUES*
(For Polycrystalline)

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
0	0	0	-459.7	500	0.210	12.1	440.3
1	(0.111)‡	(6.41)	-457.9	600	0.207	12.0	620.3
2	(0.223)	(12.9)	-456.1	700	0.209	12.1	800.3
3	0.333	19.2	-454.3	800	0.216	12.5	980.3
4	0.442	25.5	-452.5	900	0.226	13.1	1160
5	0.549	31.7	-450.7	1000	0.237	13.7	1340
6	0.652	37.7	-448.9	1100	0.248	14.3	1520
7	0.748	43.2	-447.1	1200	0.257	14.8	1700
8	0.837	48.4	-445.3	1300	0.266	15.4	1880
9	0.916	52.9	-443.5	1400	0.275	15.9	2060
10	0.984	56.9	-441.7	1500	0.282	16.3	2240
11	1.04	60.1	-439.9	1600	0.290	16.8	2420
12	1.08	62.4	-438.1	1700	0.297	17.2	2600
13	1.11	64.1	-437.3	1800	0.302	17.4	2780
14	1.13	65.3	-434.5	1900	0.308	17.8	2960
15	1.13	65.3	-432.7	2000	(0.313)	(18.1)	3140
16	1.12	64.7	-430.9				
18	1.08	62.4	-427.3				
20	1.01	58.4	-423.7				
25	0.85	49.1	-414.7				
30	0.74	42.8	-405.7				
35	0.65	37.6	-396.7				
40	0.58	33.5	-387.7				
45	0.535	30.9	-378.7				
50	0.497	28.7	-369.7				
60	0.442	25.5	-351.7				
70	0.403	23.3	-333.7				
80	0.373	21.6	-315.7				
90	0.350	20.2	-297.7				
100	0.332	19.2	-279.7				
150	(0.278)	(16.1)	-189.7				
200	(0.252)	(14.6)	-99.7				
250	(0.237)	(13.7)	-9.7				
273.2	(0.232)	(13.4)	32.0				
300	0.227	13.1	80.3				
350	0.221	12.8	170.3				
400	0.216	12.5	260.3				

REMARKS

The recommended values are for well-annealed 99.95$^+$% pure zirconium with residual electrical resistivity ρ_0 = 0.219 $\mu\Omega$ cm (characterization by ρ_0 becomes important below room temperature). The values below 1.5 T_m are calculated to fit the experimental data by using n = 2.2, α' = 7.45 x 10^{-4}, and β = 8.98. The recommended values that are supported by experimental thermal conductivity data are thought to be accurate to within 5% of the true values near room temperature and 5 to 15% at other temperatures.

* T_1 in K, k_1 in Watt cm^{-1} K^{-1}, T_2 in F, and k_2 in Btu hr^{-1} ft^{-1} F^{-1}.

‡ Values in parentheses are extrapolated or interpolated.

SPECIFICATION TABLE NO. 70 THERMAL CONDUCTIVITY OF [ALUMINUM + ANTIMONY] ALLOYS

(Al + Sb ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Sb	Composition (continued), Specifications and Remarks
1	230	L	1925	325.2			90.0	10.0	Approx composition, total impurity < 0.03 in each metal; specimen 1.9 cm in dia and 10 cm long; supplied by Baker; electrical conductivity 24.1 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
2	230	L	1925	325.2			80.0	20.0	Similar to above specimen except electrical conductivity, 17.9 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
3	230	L	1925	325.2			70.0	30.0	Similar to above specimen except electrical conductivity, 13.3 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
4	230	L	1925	325.2			60.0	40.0	Similar to above specimen except electrical conductivity, 7.90 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
5	230	L	1925	325.2			50.0	50.0	Similar to above specimen except electrical conductivity, 5.14 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.

DATA TABLE NO. 70 THERMAL CONDUCTIVITY OF [ALUMINUM + ANTIMONY] ALLOYS

(Al + Sb ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 4*	
325.2	1.833	325.2	1.004
CURVE 2*		CURVE 5*	
325.2	1.594	325.2	0.808
CURVE 3*			
325.2	1.406		

* No graphical presentation

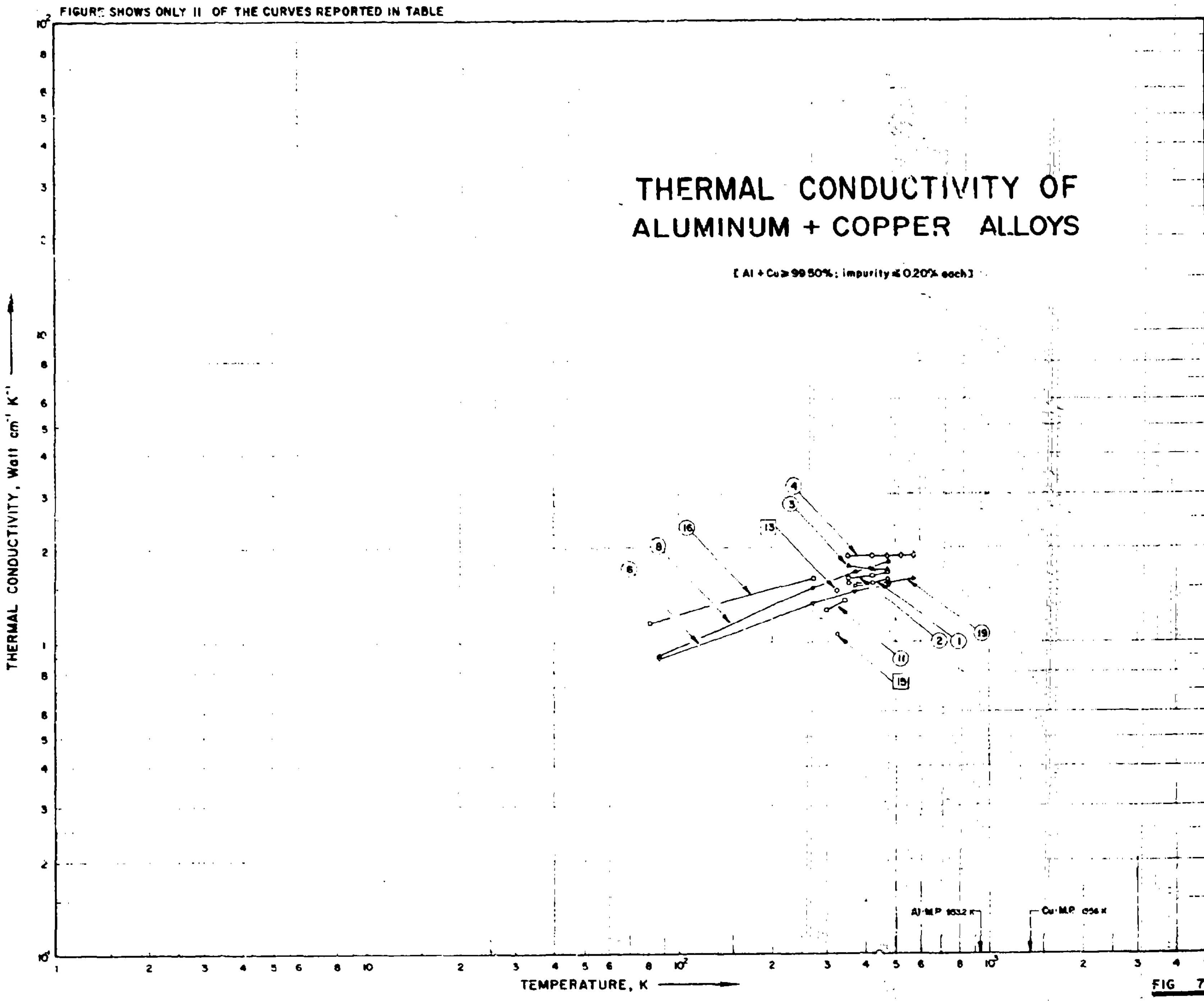


FIGURE SHOWS ONLY 11 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
ALUMINUM + COPPER ALLOYS
[Al + Cu ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Al M.P. 933.2 K
Cu M.P. 1356 K
1
2
3
4
6
8
11
13
15
16
19

FIG. 71

SPECIFICATION TABLE NO. 71 THERMAL CONDUCTIVITY OF [ALUMINUM + COPPER] ALLOYS

(Al + Cu ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 71]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Cu	Composition (continued), Specifications and Remarks
1	55	L	1928	353-473		No. 655	86.0	14.0	Approx. composition; specimen 2.53 cm in diameter and 38 cm long; cast; electrical resistivity reported at 353, 423, 473, 523, 573, and 623 K respectively as 5.24, 6.25, 6.97, 7.69, 8.40 and 9.14 μ ohm cm.
2	55	L	1928	353-473		No. 671	88.0	12.0	Specimen 2.53 cm in diameter and 38 cm long; cast; electrical resistivity reported at 353, 423, 473, 523, 573, and 623 K respectively as 5.20, 5.96, 6.51, 7.03, 7.57 and 8.11 μ ohm cm.
3	55	L	1928	353-473		No. 921	~88.0	~12.0	Trace Fe; specimen 2.53 cm in diameter and 38 cm long; cast; electrical resistivity reported at 353, 423, 473, 523, 573, 623 K respectively as 4.64, 5.61, 6.34, 7.12, 7.95, 8.82 μ ohm cm.
4	55	L	1928	353-573		No. 2313	92.0	8.0	Specimen 2.53 cm in diameter and 38 cm long; cast; electrical resistivity reported at 353, 423, 473, 523, 573 and 623 K respectively as 4.06, 4.77, 5.40, 6.16, 7.03 and 8.08 μ ohm cm.
5	55	L	1928	353-573		No. 2312	95.5	4.5	Specimen 2.53 cm in diameter and 38 cm long; cast; electrical resistivity reported at 353, 423, 473, 523, 573 and 623 K respectively as 4.04, 4.96, 5.61, 6.26, 6.92 and 7.58 μ ohm cm.
6	93	L	1931	87-476	3-4		92.0	8.0	Approx. composition; cast; electrical conductivity reported at 87, 273, 373 and 476 K respectively as 65.1, 29.3, 20.2 and 14.6 x 10^4 ohm^{-1} cm^{-1}.
7	93	L	1931	87-476	3-4		92.0	8.0	Approx. composition; cast; electrical conductivity reported at 87, 273, 373 and 476 K respectively as 65.1, 29.3, 20.2, and 14.6 x 10^4 ohm^{-1} cm^{-1}.
8	93	L	1931	87-476	3-4		85.0	15.0	Approx. composition; cast; electrical conductivity reported at 87, 273, 373 and 476 K respectively as 59.6, 22.2, 16.0 and 14.2 x 10^4 ohm^{-1} cm^{-1}.
9	53	E	1927	353-423	1.0		96.0	4.0	Approx. composition; cast.
10	53	E	1927	373.2			88.0	12.0	Approx. composition; cast; density 2.95 g cm^{-3}; electrical conductivity 0.16 x 10^6 ohm^{-1} cm^{-1} at 100 C.
11	25		1921	301, 346			~92.0	~8.0	Trace Si.
12	230	L	1925	326.2			90.0	10.0	Approx. composition, total impurity < 0.03 in each metal; prepared by fusing; specimen 1.9 cm in diameter and 10 cm long; supplied by Baker; electrical conductivity 26.0 x 10^4 ohm^{-1} cm^{-1} at 23 C.
13	230	L	1925	326.2			80.0	20.0	Similar to the above specimen except electrical conductivity, 20.9 x 10^4 ohm^{-1} cm^{-1} at 23 C.

SPECIFICATION TABLE NO. 71 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Cu	Composition (continued), Specifications and Remarks
14	230	L	1925	326.2			70.0	30.0	Similar to above except electrical conductivity 18.5 x 10^4 ohm^{-1} cm^{-1} at 23 C.
15	230	L	1925	326.2			50.0	50.0	Similar to above except electrical conductivity 15.3 x 10^4 ohm^{-1} cm^{-1} at 23 C
16	36	R	1935	81.273	1.0		96.0	4.0	Approx. composition; cast sheet; annealed at 510 C for 45 min. and quenched in ice water.
17	826		1934	293, 473			88.0	12.0	Density 3.0 g cm^{-3}; Brinell hardness number 80.
18	98	L	1922	373-573		V 671 A	88.0	12.0	Approx. composition; specimen 15 in. long and 1 in. in diameter; supplied by Metallurgical Dept. of National Physical Laboratory (England); chill cast.
19	98	L	1922	373-573		V 671 D	88.0	12.0	Approx. composition; commercially pure aluminum, specimen 15 ins. long and 1 in. in diameter; supplied by Metallurgical Dept. of National Physical Lab.; annealed at 450 C.
20	98	L	1922	373-573		V 671 C	88.0	12.0	Similar to above specimen except sand cast.

DATA TABLE NO. 71 THERMAL CONDUCTIVITY OF ALUMINUM + COPPER ALLOYS

(Al + Cu ≥ 99.50%; impurity ≤ 0.20% each)

Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}

T	k
CURVE 1	
353.00	1.548
423.00	1.548
473.00	1.590
CURVE 2	
353.00	1.590
423.00	1.632
473.00	1.674
CURVE 3	
353.00	1.757
423.00	1.715
473.00	1.715
CURVE 4	
353.00	1.883
423.00	1.883
473.00	1.883
523.00	1.883
573.00	1.883
CURVE 5*	
353.00	1.883
423.00	1.883
473.00	1.883
523.00	1.883
573.00	1.925
CURVE 6	
87	0.887
273	1.32
373	1.44
476	1.52
CURVE 7*	
87	0.895
273	1.32
373	1.45
476	1.52
CURVE 8	
87	0.904
273	1.48
373	1.67
476	1.81
CURVE 9*	
353.0	1.674
373.0	1.674
393.0	1.674
423.0	1.674
CURVE 10*	
373.2	1.42
CURVE 11	
301.00	1.268
345.80	1.347
CURVE 12*	
326.2	1.61
CURVE 13	
326.2	1.46
CURVE 14*	
326.2	1.30
CURVE 15	
326.2	1.06
CURVE 16	
81.20	1.155
273.20	1.596
CURVE 17*	
293	1.46
473	1.67
CURVE 18*	
373	1.60
473	1.64
573	1.69
CURVE 19	
373	1.51
473	1.55
573	1.59
CURVE 20*	
373	1.42
473	1.51
573	1.55

* Not shown on plot

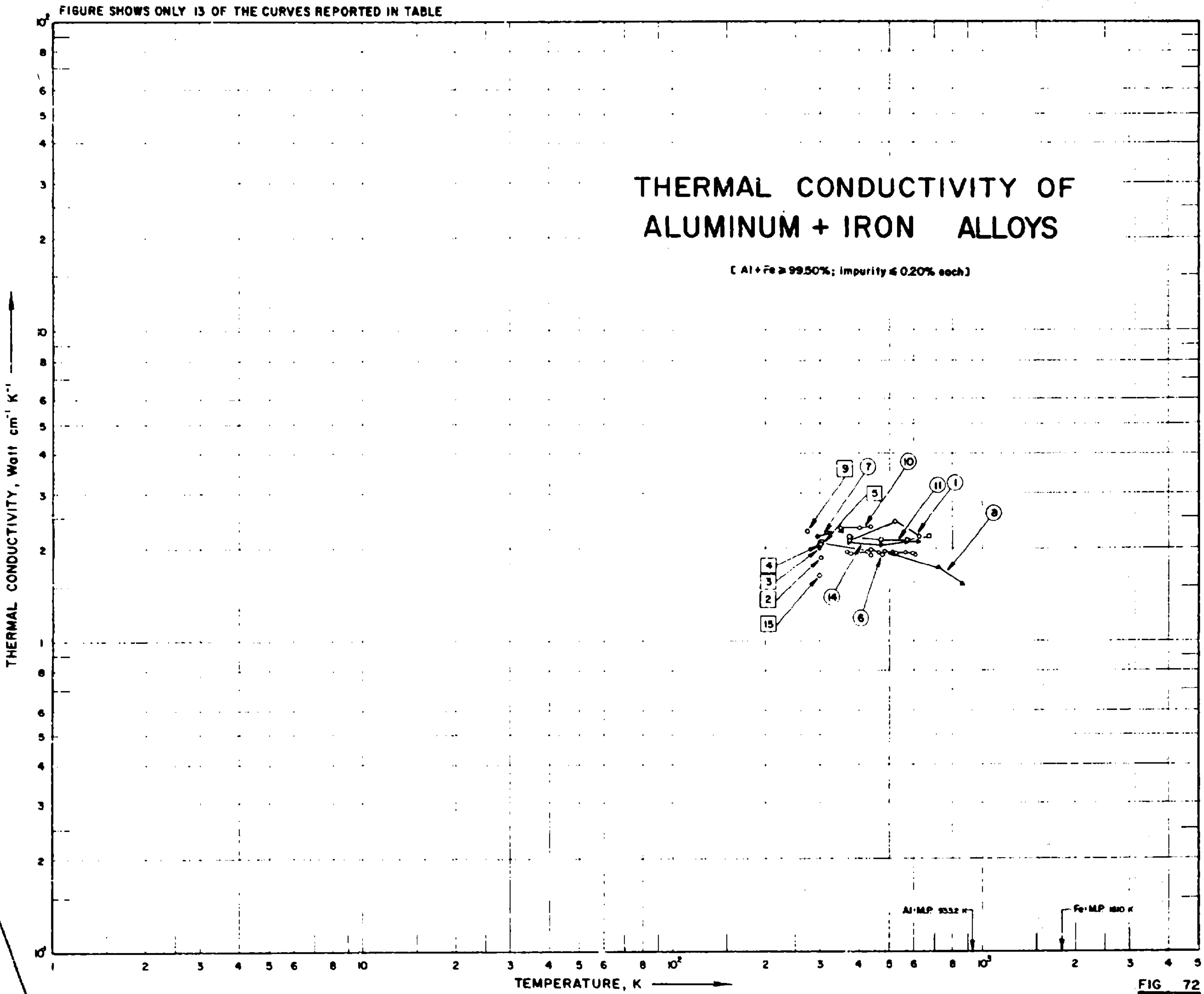


FIGURE SHOWS ONLY 13 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF ALUMINUM + IRON ALLOYS
[Al + Fe ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Al: M.P. 933.2 K
Fe: M.P. 1810 K

FIG 72

SPECIFICATION TABLE NO. 72 THERMAL CONDUCTIVITY OF [ALUMINUM + IRON] ALLOYS

(Al + Fe ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 72]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Fe	Composition (continued), Specifications and Remarks
1	225	L	1928	373-623			99.57	0.24	0.19 Si, trace Cu; specimen 12 in. long and 1 in. in diameter; annealed at 530 C for 5 hrs. before machining.
2	408	E	1925	302.2	< 0.5	AL	99.354	0.509	0.137 Si; specimen 5 mm thick and 29 cm long; chill-cast; specific gravity 2.70; specific resistance 0.354 x 10^{-5} ohm cm^{-1}.
3	408	E	1925	299.2	< 0.5	AL	99.354	0.509	0.137 Si; the above specimen annealed at 450 C for 30 min.; specific resistance 0.331 x 10^{-5} ohm cm^{-1}.
4	408	E	1925	301.2	< 0.5	AL	99.354	0.509	0.137 Si; specimen about 3 mm thick and 20 cm long; forged and cold-drawn; specific resistance 0.316 x 10^{-5} ohm cm^{-1}.
5	408	E	1925	304.2	< 0.5	AL	99.354	0.509	0.137 Si; the above specimen annealed at 500 C for 30 min.; specific resistance 0.313 x 10^{-5} ohm cm^{-1}.
6	30	L	1925	364-609	< 2.0		99.5	0.43	0.07 Si, trace Cu; commercially pure Al; specimen 15.5 in. long and 0.75 in. in diameter; cast.
7	17	L	1958	293-353	± 1.0	DIN 712	99.5	~0.32	0.019 Cu, 0.034 Zn, 0.019 Mg, 0.021 Mn, 0.012 Ti, 0.16 Si commercial pure aluminum; density 2.703 g cm^{-3} at 20 C.
8	15	F	1947	298-863	1.0-5.0	AL-2	99.20	0.67	0.10 Si, 0.01 Cu, <0.01 Mn and Mg; specimen 25 cm long and 2.5 cm in diameter.
9	410	R	1935	273.2	1.0	AL-2	99.66	0.2	0.14 Si.
10	54	L	1927	350-437			99.6	0.2	0.2 Si, single crystal; specimen 2.54 cm in diameter and 38 cm long, supplied by National Physical Lab.; specific resistivity 2.89 x 10^{-6} ohm cm^{-1} at 18 C.
11	98	L	1922	373-673		1	99.48	0.38	0.14 Si, trace Cu supplied by National Physical Lab.; chill-cast.
12	98	L	1922	373-673		2	99.48	0.38	0.14 Si, trace Cu; supplied by National Physical Lab.; chill-cast.
13	98	L	1922	373-623		1	99.48	0.38	0.14 Si, trace Cu; supplied by National Physical Lab.; sand-cast.
14	98	L	1922	373-623		2	99.48	0.38	0.14 Si, trace Cu; supplied by National Physical Lab.; sand-cast.
15	827	L	1958	298.2			92.4	7.6	Produced by powder metallurgical process; extruded rod 3/4 in. in diameter; heated at 800 F for 100 hrs.; density 2.88 g cm^{-3}.

DATA TABLE NO. 72 THERMAL CONDUCTIVITY OF [ALUMINUM + IRON] ALLOYS

(Al + Fe > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
373.2	2.117
523.2	2.410
623.2	2.184

CURVE 2

T	k
302.2	1.858

CURVE 3

T	k
299.2	2.000

CURVE 4

T	k
301.2	2.059

CURVE 5

T	k
304.2	2.071

CURVE 6

T	k
364.2	1.95*
367.2	1.95
375.2	1.92*
423.7	1.92*
425.2	1.95*
427.7	1.95*
438.2	1.88
438.7	1.97
461.2	1.94
475.7	1.90
485.2	1.96
512.7	1.95
527.7	1.93
565.2	1.94
594.2	1.92
608.7	1.90

CURVE 7

T	k
293.2	2.185
323.2	2.220
353.2	2.255

CURVE 8

T	k
298.2	2.090
518.2	1.910
723.2	1.730
863.2	1.530

CURVE 9

T	k
273.2	2.259

CURVE 10

T	k
349.6	2.305
400.6	2.310
437.1	2.330

CURVE 11

T	k
373.2	2.18
473.2	2.13
573.2	2.13
673.2	2.18

CURVE 12*

T	k
373.2	2.13
473.2	2.13
573.2	2.16
673.2	2.22

CURVE 13

T	k
373.2	2.09
473.2	2.09
573.2	2.09
623.2	2.18

CURVE 14

T	k
373.2	2.09
473.2	2.05
573.2	2.09
623.2	2.09

CURVE 15

T	k
298.2	1.63

* Not shown on plot

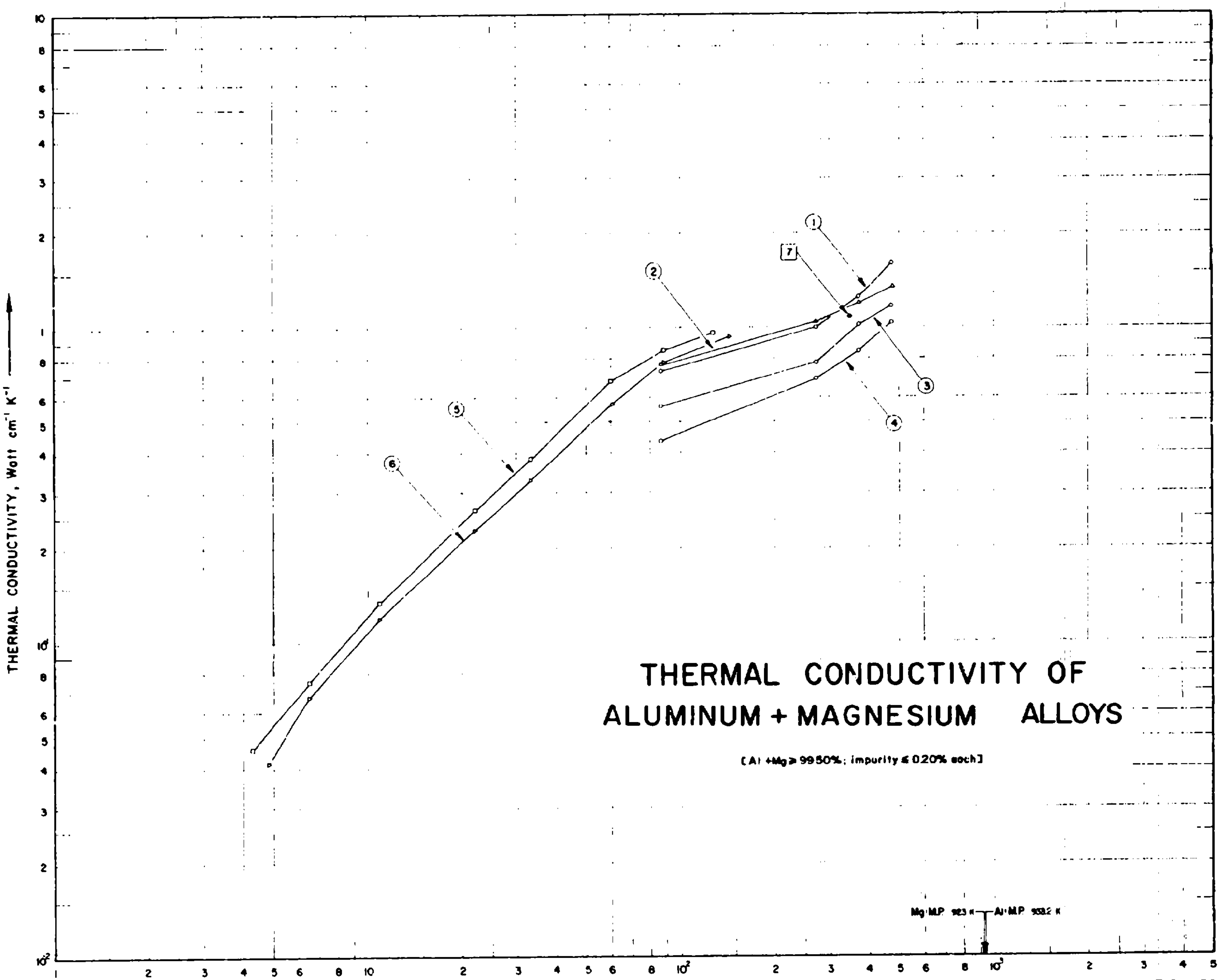

THERMAL CONDUCTIVITY OF ALUMINUM + MAGNESIUM ALLOYS
[Al +Mg ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Mg M.P. 923 K
Al M.P. 933.2 K
1
2
3
4
5
6
7

FIG 73

SPECIFICATION TABLE NO. 73 THERMAL CONDUCTIVITY OF [ALUMINUM + MAGNESIUM] ALLOYS

(Al + Mg ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 73]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Mg	Composition (continued), Specifications and Remarks
1	93	L	1931	87-476	3.0-4.0		92.0	8.0	Approx. composition; cast; electrical conductivity reported at 87, 273, 373 and 476 K respectively as 20.02, 13.21, 10.5 and 8.8 x 10^4 ohm^{-1} cm^{-1}
2	93	L	1931	87-476	3.0-4.0		92.0	8.0	Approx. composition; annealed; electrical conductivity reported at 87, 273, 373 and 476 K respectively as 24.5, 15.05, 12.25 and 10.25 x 10^4 ohm^{-1} cm^{-1}.
3	93	L	1931	87-476	3.0-4.0		88.0	12.0	Approx. composition; cast; electrical conductivity reported at 87, 273, 373 and 476 K respectively as 19.6, 11.95, 9.4, 7.85 x 10^4 ohm^{-1} cm^{-1}.
4	93	L	1931	87-476	3.0-4.0		86.0	14.0	Approx. composition; annealed; electrical conductivity reported at 87, 273, 373 and 476 K respectively as 12.7, 8.96, 8.05 and 7.6 x 10^4 ohm^{-1} cm^{-1}.
5	828		1960	4.3-128		5052	97.7-97.1	2.2-2.8	0.10 Mn; annealed.
6	828		1960	4.8-144		5154	96.8-96.0	3.1-3.9	0.10 Mn; annealed.
7	829		1940	348.2		Magnalium	93.0	7.0	Approx. composition; specimen 15 mm in diameter and 72 mm long; density 2.63 g cm^{-3}.

DATA TABLE NO. 73 THERMAL CONDUCTIVITY OF [ALUMINUM + MAGNESIUM] ALLOYS

(Al + Mg > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
87	0.728
273	1.000
373	1.264
476	1.398
CURVE 2	
87	0.766
273	1.046
372	1.201
476	1.356
CURVE 3	
87	0.561
273	0.774
373	1.013
476	1.184
CURVE 4	
87	0.435
273	0.690
373	0.845
476	1.042
CURVE 5	
4.28	0.0462
6.50	0.0753
10.9	0.134
22.1	0.265
33.2	0.384
60.9	0.675
88.7	0.846
127.6	0.961
CURVE 6	
4.83	0.0415
6.50	0.0675
10.9	0.119

T	k
CURVE 6 (cont.)	
22.1	0.228
33.2	0.327
60.9	0.571
88.7	0.779
144.3	0.935
CURVE 7	
348.2	1.087

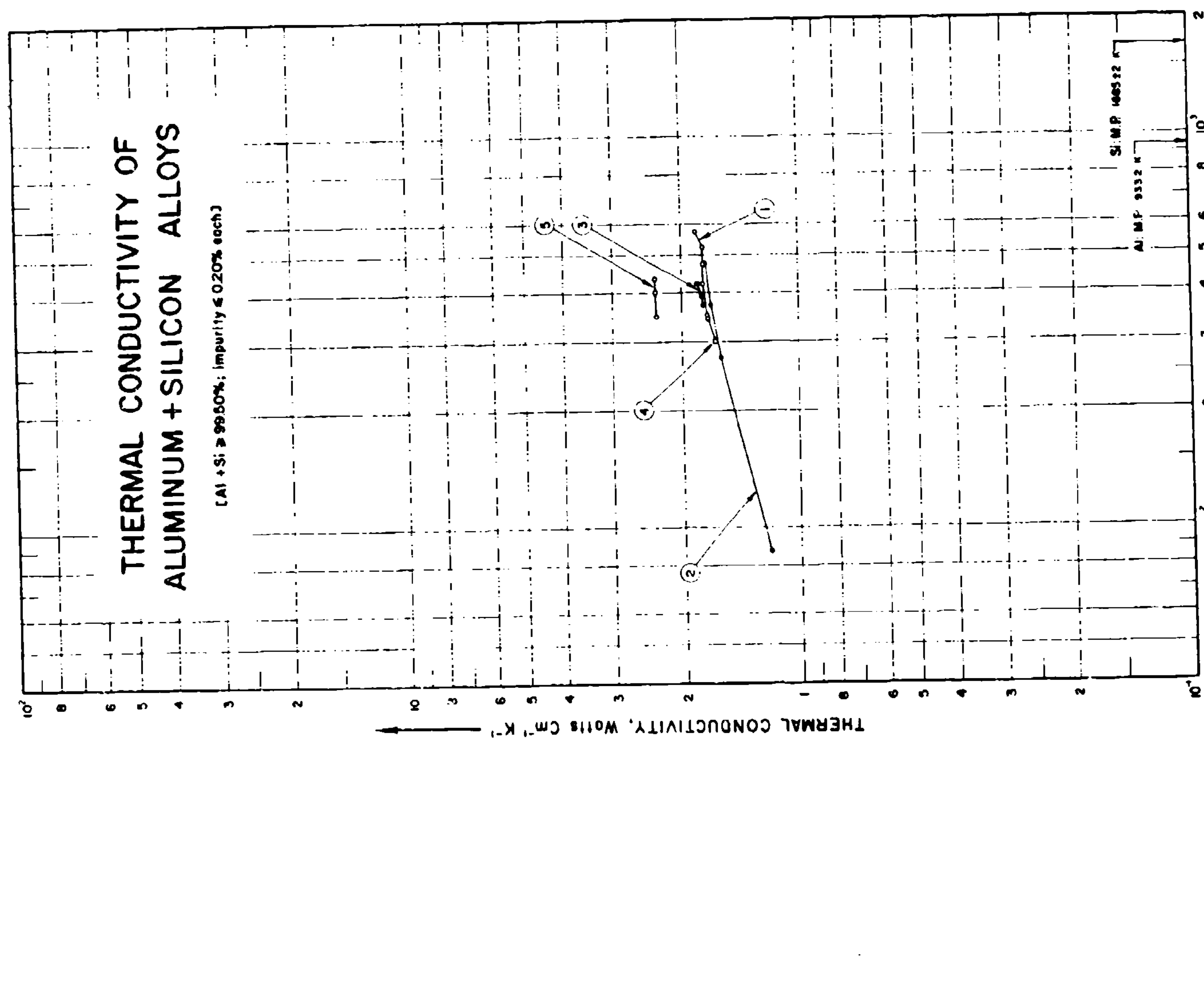

THERMAL CONDUCTIVITY OF
ALUMINUM + SILICON ALLOYS
(Al + Si ≥ 99.50%; Impurity ≤ 0.20% each)
Al: M.P. 933.2 K
Si: M.P. 1685±2 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 74

SPECIFICATION TABLE NO. 74 THERMAL CONDUCTIVITY OF [ALUMINUM + SILICON] ALLOYS

(Al + Si ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 74]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Si	Composition (continued), Specifications and Remarks
1	55	L	1928	353-573		2358	87.0	13.0	Nominal composition; fine structure cause by adding trace Na at high temp.; specimen 1 1/4 in. in diameter and 15 in. long; vertically sand cast; annealed at 450 C for 1 hr.; electrical resistivity reported at 353, 423, 473, 523, 573 and 623 K respectively as 5.36, 6.48, 7.31, 8.18, 9.07 and 10.0 μ ohm cm.
2	93	L	1931	87-476	3.0-4.0	Alusil	80.0	20.0	Nominal composition; as cast; electrical conductivity reported at 87, 273, 373 and 476 K respectively as 41.10, 17.23, 13.40 and 10.6 x 10^4 ohm^{-1} cm^{-1}.
3	53	E	1927	373-423	1.0	Alpax	87.0	13.0	Approx. composition; as cast; density 2.65 g cm^{-3}.
4	25		1921	301,346			89.0-86.0	11.0-14.0	No details reported.
5	54	L	1927	350-437			99.6	0.2	0.2 Fe, single crystal; specimen 2.54 cm in diameter and 38 cm long; supplied by National Physical Lab.; specific resistivity 2.89 x 10^{-6} ohms cm^{-3} at 18 C.

DATA TABLE NO. 74 THERMAL CONDUCTIVITY OF [ALUMINUM + SILICON] ALLOYS

(Al + Si ≥ 99.50%; impurity ≤ 0.2% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
353.0	1.715
423.0	1.757
473.0	1.757
523.0	1.757
573.0	1.799
CURVE 2	
87.0	1.205
273.0	1.586
373.0	1.686
476.0	1.745
CURVE 3	
373.0	1.757
393.0	1.778
423.0	1.820
CURVE 4	
201.0	1.632
346.2	1.703
CURVE 5	
349.6	2.305
400.0	2.310
437.1	2.330

SPECIFICATION TABLE NO. 75 THERMAL CONDUCTIVITY OF (ALUMINUM + TIN) ALLOYS

(Al + Sn > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Sn	Composition (continued), Specifications and Remarks
1	230	L	1925	324.2			90.0	10.0	Approx composition; total impurity < 0.03 in each metal; specimen 1.9 cm in dia and 10 cm long; supplied by Baker; electrical conductivity, 28.9 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
2	230	L	1925	324.2			70.0	30.0	Similar to above specimen except electrical conductivity, 22.8 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
3	230	L	1925	324.2			50.0	50.0	Similar to above specimen except electrical conductivity, 19.1 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.

DATA TABLE NO. 75 THERMAL CONDUCTIVITY OF (ALUMINUM + TIN) ALLOYS

(Al + Sn > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
324.2	1.862
CURVE 2*	
324.2	1.732
CURVE 3*	
324.2	1.393

* No graphical presentation

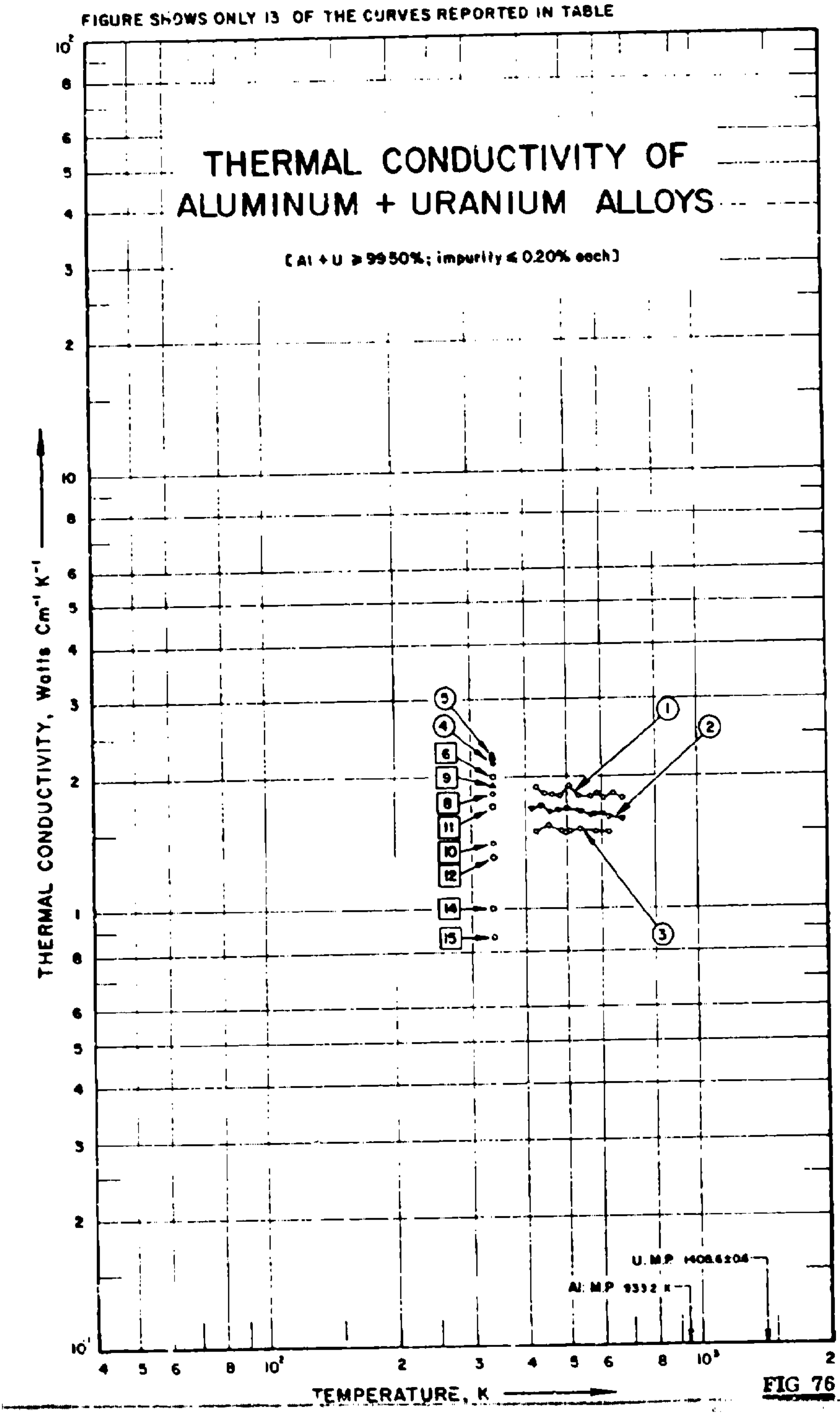


FIGURE SHOWS ONLY 13 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
ALUMINUM + URANIUM ALLOYS
[Al + U ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
U. M.P.
Al. M.P. 933.2 K
1
2
3
4
5
6
8
9
10
11
12
14
15

FIG 76

SPECIFICATION TABLE NO. 76 THERMAL CONDUCTIVITY OF [ALUMINUM + URANIUM] ALLOYS

(Al + U ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 76]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	U	Composition (continued), Specifications and Remarks
1	125	C	1955	424-671			87.5	12.5	Nominal composition; forged bar; annealed for 0.5 hr. at 370 C; pure lead used as standard.
2	125	C	1955	415-671			77.3	22.7	Similar to the above specimen.
3	125	C	1955	426-625			69.5	30.5	Similar to the above specimen.
4	591	C	1963	338.2			99.5	0.5	Nominal composition; cast from reactor-grade uranium (99.5$^+$ pure) and aluminum (99.99 pure); specimen 3 in. long, 0.500 in. diameter; measured in a vacuum of < 5 x 10^{-4} mm Hg, copper used as standard.
5	591	C	1963	338.2			99.5	0.5	The above specimen heat treated 5 days at 620 C.
6	591	C	1963	338.2			93.03	6.97	Nominal composition; cast from reactor-grade uranium (99.5$^+$ pure) and aluminum (99.99 pure); specimen 3 in. long, 0.500 in. dia.; measured in a vacuum of <5 x 10^{-4} mm Hg; copper used as standard.
7	591	C	1963	338.2			93.03	6.97	The above specimen heat treated 5 days at 620 C.
8	591	C	1963	338.2			87.09	12.91	Calculated composition; cast from reactor-grade uranium (99.5$^+$ pure) and aluminum (99.99 pure); specimen 3 in. long, 0.500 in. dia.; measured in a vacuum of <5 x 10^{-4} mm Hg; copper used as standard.
9	591	C	1963	338.2			87.09	12.91	The above specimen heat treated 5 days at 620 C.
10	591	C	1963	338.2			78.57	21.43	Calculated composition; cast from reactor-grade uranium (99.5$^+$ pure) and aluminum (99.99 pure); 3 in. long, 0.500 in. dia.; measured in a vacuum of < 5 x 10^{-4} mm Hg; copper used as standard.
11	591	C	1963	338.2			78.57	21.43	The above specimen heat treated for 5 days at 620 C.
12	591	C	1963	338.2			67.06	32.94	Approx. composition (impurities by spectrographic analysis: < 0.10 Fe, < 0.07 Si, <0.04 Ca; and <0.02 B); cast from reactor-grade uranium (99.5$^+$ pure) and aluminum (99.99 pure); 3 in. long, 0.500 in. dia.; measured in a vacuum of <5 x 10^{-4} mm Hg; copper used as standard.
13	591	C	1963	338.2			67.06	32.94	The above specimen heat treated for 5 days at 620 C.
14	591	C	1963	338.2			57.51	42.49	Cast from reactor-grade uranium (99.5$^+$ pure) and aluminum (99.99 pure); specimen 3 in. long, 0.600 in. dia.; measured in a vacuum of <5 x 10^{-4} mm Hg; copper used as standard.
15	591	C	1963	338.2			57.51	42.49	The above specimen heat treated for 5 days at 620 C.

DATA TABLE NO. 76 THERMAL CONDUCTIVITY OF [ALUMINUM + URANIUM] ALLOYS

(Al + U > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k
CURVE 1	
423.5	1.88
441.7	1.83
462.3	1.82
481.7	1.80
503.5	1.90
531.4	1.79
5[illegible]6.5	1.78
548.4	1.82
604.1	1.75
639.3	1.81
670.9	1.76
CURVE 2	
415.0	1.69
436.8	1.71
455.0	1.66
478.0	1.66
498.7	1.69
532.6	1.66
537.4	1.66
567.8	1.62
579.9	1.63
605.3	1.64
624.7	1.60
670.8	1.59
CURVE 3	
425.9	1.49
452.6	1.55
485.3	1.50
496.2	1.46
503.5	1.48
537.4	1.50
581.1	1.49
624.7	1.48
CURVE 4	
338.2	2.19
338.2	2.20
CURVE 5	
338.2	2.25
338.2	2.24
338.2	2.23
CURVE 6	
338.2	1.99
CURVE 7*	
338.2	2.04
CURVE 8	
338.2	1.83
CURVE 9	
338.2	1.90
CURVE 10	
338.2	1.41
CURVE 11	
338.2	1.71
CURVE 12	
338.2	1.32
CURVE 13*	
338.2	1.31
CURVE 14	
338.2	1.00
CURVE 15	
339.2	0.866

* Not shown on plot

SPECIFICATION TABLE NO. 77 THERMAL CONDUCTIVITY OF [ALUMINUM + ZINC] ALLOYS

(Al + Zn > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Zn	Composition (continued), Specifications and Remarks
1	230	L	1925	323.2			90	10	Approx composition; prepared by using aluminum and zinc, each containing < 0.03 total impurities; supplied by Baker; specimen 10 cm long, 1.9 cm dia; electrical conductivity 25.0 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
2	230	L	1925	323.2			80	20	Similar to the above specimen except electrical conductivity, 19.6 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
3	230	L	1925	323.2			70	30	Similar to the above specimen except electrical conductivity, 18.7 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.

DATA TABLE NO. 77 THERMAL CONDUCTIVITY OF [ALUMINUM + ZINC] ALLOYS

(Al + Zn > 99.50%; impurity < 0.20% each)

[Temperature, T,K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
323.2	1.619
CURVE 2*	
323.2	1.360
CURVE 3*	
323.2	1.326

* No graphical presentation

SPECIFICATION TABLE NO. 78 THERMAL CONDUCTIVITY OF [ANTIMONY + ALUMINUM] ALLOYS

(Sb + Al > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb	Al	Composition (continued), Specifications and Remarks
1	230	L	1925	325.2			50	50	Approx composition; prepared by fusing aluminum and antimony, each containing < 0.03 impurities; supplied by Baker; 10 cm long, 1.9 cm dia, electrical conductivity, 5.44 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
2	230	L	1925	325.2			60	40	Similar to the above specimen except electrical conductivity, 1.79 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
3	230	L	1925	325.2			70	30	Similar to the above specimen except electrical conductivity, 0.74 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
4	230	L	1925	325.2			80	20	Similar to the above specimen except electrical conductivity, 0.014 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.
5	230	L	1925	325.2			90	10	Similar to the above specimen except electrical conductivity, 0.119 x 10^4 $ohm^{-1}cm^{-1}$ at 23 C.

DATA TABLE NO. 78 THERMAL CONDUCTIVITY OF [ANTIMONY + ALUMINUM] ALLOYS

(Sb + Al ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 4*	
325.2	0.808	325.2	0.219
CURVE 2		CURVE 5*	
325.2	0.477	325.2	0.243
CURVE 3*			
325.2	0.418		

* No graphical presentation

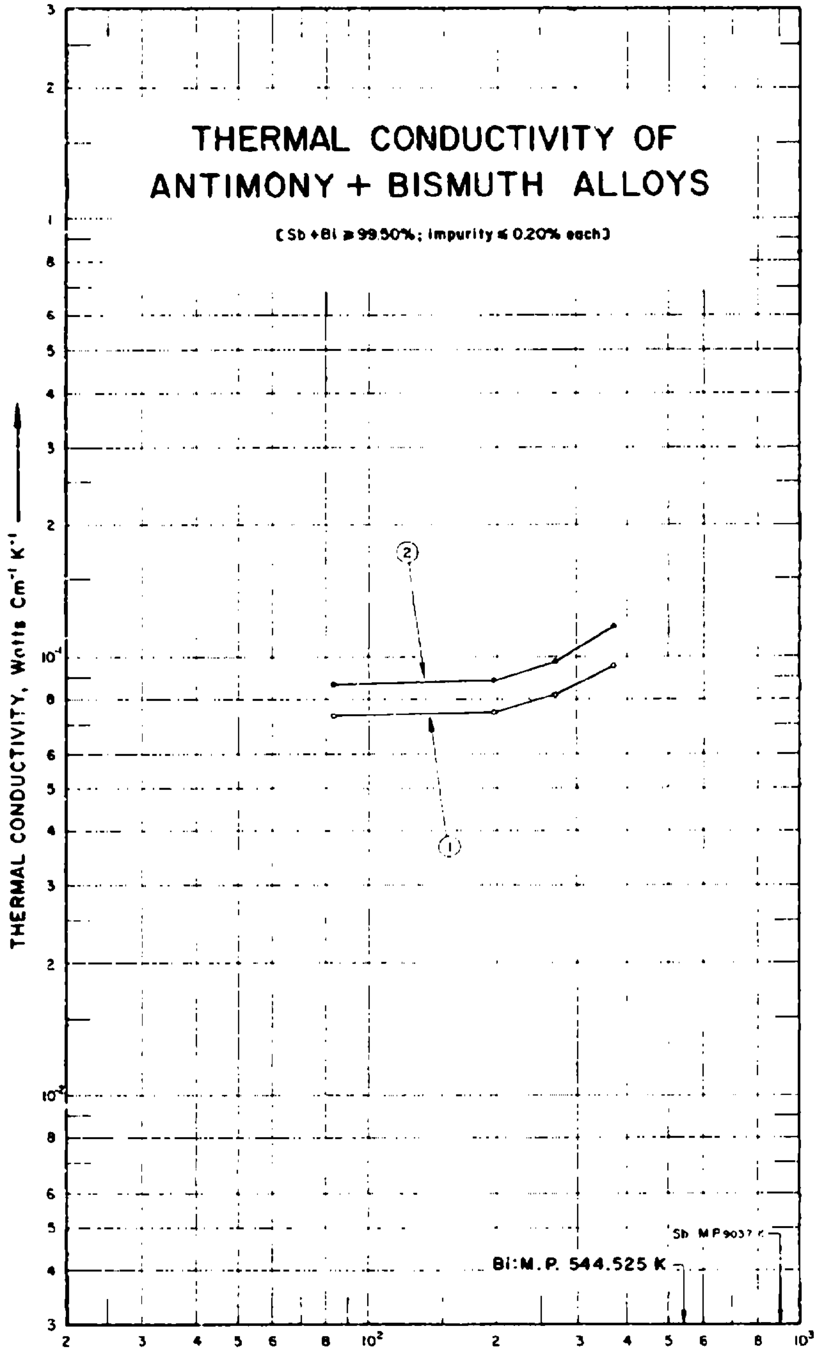

THERMAL CONDUCTIVITY OF
ANTIMONY + BISMUTH ALLOYS
(Sb + Bi ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Bi: M.P. 544.525 K
Sb M.P. 903.7 K
1
2

FIG 79

SPECIFICATION TABLE NO. 79 THERMAL CONDUCTIVITY OF [ANTIMONY + BISMUTH] ALLOYS

(Sb + Bi > 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 79]

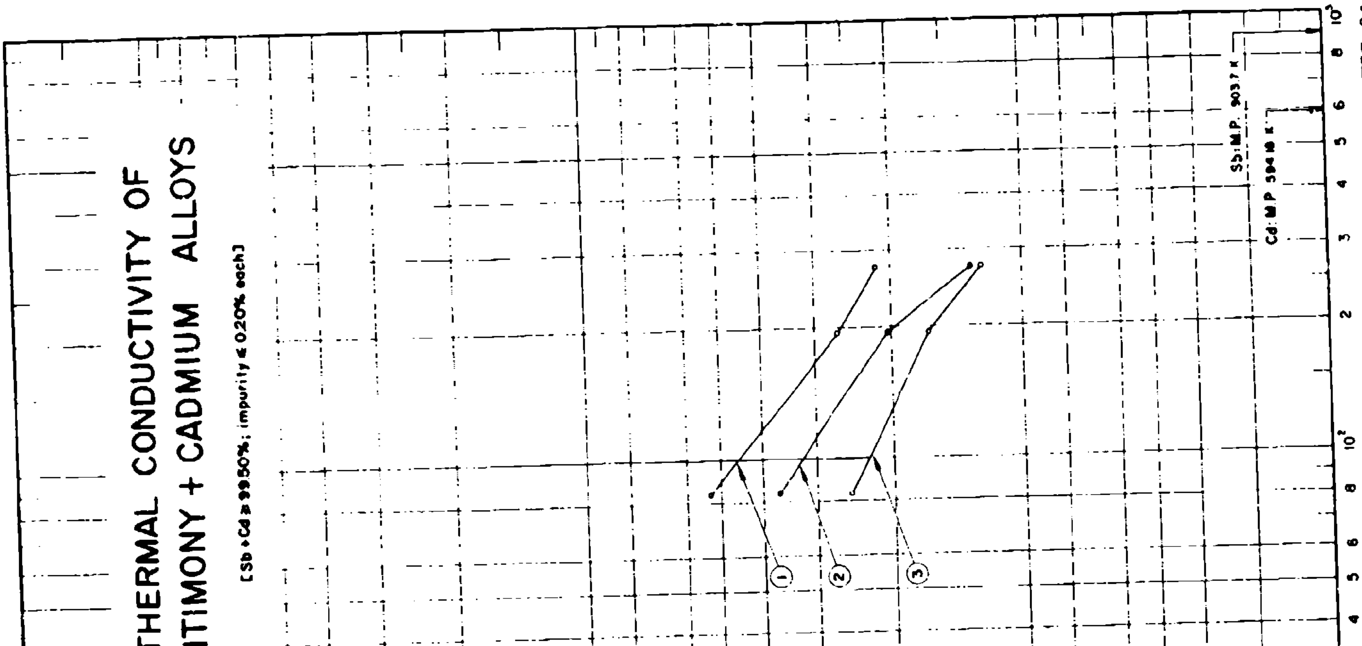
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb	Bi	Composition (continued), Specifications and Remarks
1	49	L	1913	83-373			50	50	Approx. composition.
2	49	L	1913	83-373			70	30	Approx. composition.

DATA TABLE NO. 79 THERMAL CONDUCTIVITY OF [ANTIMONY + BISMUTH] ALLOYS

(Sb + Bi ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K, Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
83.2	0.0732
196.2	0.0745
273.2	0.0820
373.2	0.0958
CURVE 2	
83.2	0.0862
196.2	0.0083
273.2	0.0979
373.2	0.118



THERMAL CONDUCTIVITY OF
ANTIMONY + CADMIUM ALLOYS
[Sb + Cd ≥ 99.50%; impurity ≤ 0.20% each]
Sb: M.P. 903.7 K
Cd: M.P. 594.18 K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3

FIG 80

SPECIFICATION TABLE NO. 80 THERMAL CONDUCTIVITY OF [ANTIMONY + CADMIUM] ALLOYS

(Sb + Cd > 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 80]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb	Cd	Composition (continued), Specifications and Remarks
1	35	E	1912	83-273			50	50	Approx. composition; test specimens 2-3 cm in dia.; electrical conductivity 0.588×10^3, 0.795×10^3, and 1.37×10^3 $ohm^{-1} cm^{-1}$ at 0, -79, and -190 C respectively.
2	35	E	1912	83-273			51.7	48.3	Calculated composition, electrical conductivity 19.9, 31.45 and 62.6 $ohm^{-1} cm^{-1}$ at 0, -79, and -190 C respectively.
3	35	E	1912	83-273			66.7	33.3	Calculated composition: electrical conductivity 247, 272, and 202.5 $ohm^{-1} cm^{-1}$ at 0, -79, and -190 C respectively.

DATA TABLE NO. 80 THERMAL CONDUCTIVITY OF [ANTIMONY + CADMIUM] ALLOYS

($Sb + Cd \geq 99.50\%$; impurity $< 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
83.2	0.0530
194.2	0.0265
273.2	0.0217
CURVE 2	
83.2	0.0369
194.2	0.0205
273.2	0.0132
CURVE 3	
83.2	0.0250
194.2	0.0165
273.2	0.0125

SPECIFICATION TABLE NO. 81 THERMAL CONDUCTIVITY OF [ANTIMONY + COPPER] ALLOYS

(Sb + Cu ≥ 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb	Cu	Composition (continued), Specifications and Remarks
1	319, 320	P	1966	1073.2	8		50	50	Molten specimen contained in a thin-walled stainless steel cylindrical crucible of dimensions 24 mm dia x 100 mm long; electrical resistivity reported as 138 and 153 μohm cm at 700 and 800 C, respectively; thermal conductivity values calculated from the thermal diffusivity and the specific heat measurements using the density data from Bienias, A. and Sauerwald, F., Z. anorg. chem., 41, 51, 1927.
2	319, 320	P	1966	1073.2	8		60	40	Similar to the above specimen except electrical resistivity, reported as 108, 119, and 132 μohm cm at 620, 700, and 800 C, respectively.
3	319, 320	P	1966	1073.2	8		76.7	23.3	Similar to the above specimen except electrical resistivity, reported as 75.0, 85.0, and 95.3 μohm cm at 620, 700, and 800 C, respectively.
4	319, 320	P	1966	1073.2	8		80	20	Similar to the above specimen except electrical resistivity, reported as 76.9, 84.8, and 95.3 μ ohm cm at 620, 700, and 800 C, respectively.
5	319, 320	P	1966	1073.2	8		90	10	Similar to the above specimen except electrical resistivity, reported as 80.2, 90.2, and 100 μohm cm at 620, 700, and 800 C, respectively.

DATA TABLE NO. 81 THERMAL CONDUCTIVITY OF [ANTIMONY + COPPER] ALLOYS

(Sb + Cu ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k	T	k	T	k	T	k
CURVE 1*		CURVE 2*		CURVE 3*		CURVE 4*		CURVE 5*	
1073.2	0.236	1073.2	0.253	1073.2	0.288	1073.2	0.295	1073.2	0.301

* No graphical presentation

SPECIFICATION TABLE NO. 82 THERMAL CONDUCTIVITY OF (ANTIMONY + LEAD) ALLOYS

(Sb + Pb ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb	Pb	Composition (continued), Specifications and Remarks
1	230	L	1925	327.2			90	10	Approx composition; prepared by using antimony and lead, each containing < 0.03 impurities; supplied by Baker; specimen 10 cm long, 1.9 cm dia; electrical conductivity, $2.44 \times 10^4\ ohm^{-1}cm^{-1}$ at 22 C.
2	230	L	1925	327.2			80	20	Similar to the above specimen except electrical conductivity, $2.29 \times 10^4\ ohm^{-1}cm^{-1}$ at 22 C.
3	230	L	1925	327.2			70	30	Similar to the above specimen except electrical conductivity, $2.32 \times 10^4\ ohm^{-1}cm^{-1}$ at 22 C.
4	230	L	1925	327.2			60	40	Similar to the above specimen except electrical conductivity, $2.33 \times 10^4\ ohm^{-1}cm^{-1}$ at 22 C.
5	230	L	1925	327.2			50	50	Similar to the above specimen except electrical conductivity, $2.46 \times 10^4\ ohm^{-1}cm^{-1}$ at 22 C.

DATA TABLE NO. 82 THERMAL CONDUCTIVITY OF (ANTIMONY + LEAD) ALLOYS

(Sb + Pb ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k	T	k
CURVE 1*		CURVE 3*		CURVE 5*	
327.2	0.201	327.2	0.197	327.2	0.201
CURVE 2*		CURVE 4*			
327.2	0.188	327.2	0.201		

* No graphical presentation

SPECIFICATION TABLE NO. 83 THERMAL CONDUCTIVITY OF [ANTIMONY + TIN] ALLOYS

(Sb + Sn ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb	Sn	Composition (continued), Specifications and Remarks
1	230	L	1925	330.2			90	10	Approx composition; prepared by fusing antimony and tin, each containing < 0.03 total impurity; supplied by Baker; specimen 10 cm long, 1.9 cm dia; electrical conductivity, 1.99 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
2	230	L	1925	330.2			80	20	Similar to the above specimen except electrical conductivity, 1.93 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
3	230	L	1925	330.2			70	30	Similar to the above specimen except electrical conductivity, 2.29 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
4	230	L	1925	330.2			60	40	Similar to the above specimen except electrical conductivity, 2.71 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
5	230	L	1925	330.2			50	50	Similar to the above specimen except electrical conductivity, 3.46 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.

DATA TABLE NO. 83 THERMAL CONDUCTIVITY OF [ANTIMONY + TIN] ALLOYS

(Sb + Sn > 99.50%; impurity ≤ 0.20% each)

[Temperature, T,K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 4*	
330.2	0.188	330.2	0.213
CURVE 2*		CURVE 5*	
330.2	0.176	330.2	0.268
CURVE 3*			
330.2	0.197		

* No graphical presentation

SPECIFICATION TABLE NO. 84 THERMAL CONDUCTIVITY OF (BERYLLIUM + ALUMINUM) ALLOYS

($Be + Al \geq 99.50\%$; impurity $\leq 0.20\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Be	Al	Composition (continued), Specifications and Remarks
1	235	L	1944	303-336			97	3	Cylindrical specimen 2.542 cm long, 5.070 cm^2 cross sectional area.
2	918		1964	297.1			67	33	Density 2.05 gm cm^{-3}.
3	918		1964	297.1			64	36	Density 2.07 gm cm^{-3}.
4	918		1964	297.1			57	43	Density 2.14 gm cm^{-3}.

DATA TABLE NO. 84 THERMAL CONDUCTIVITY OF (BERYLLIUM + ALUMINUM) ALLOYS

($Be + Al \geq 99.50\%$; impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
303.0	1.569
313.7	1.548
319.0	1.544
324.7	1.527
328.0	1.515
330.3	1.523
337.6	1.515
CURVE 2*	
297.1	1.92
CURVE 3*	
297.1	1.65

T	k
CURVE 4*	
297.1	1.55

* No graphical presentation

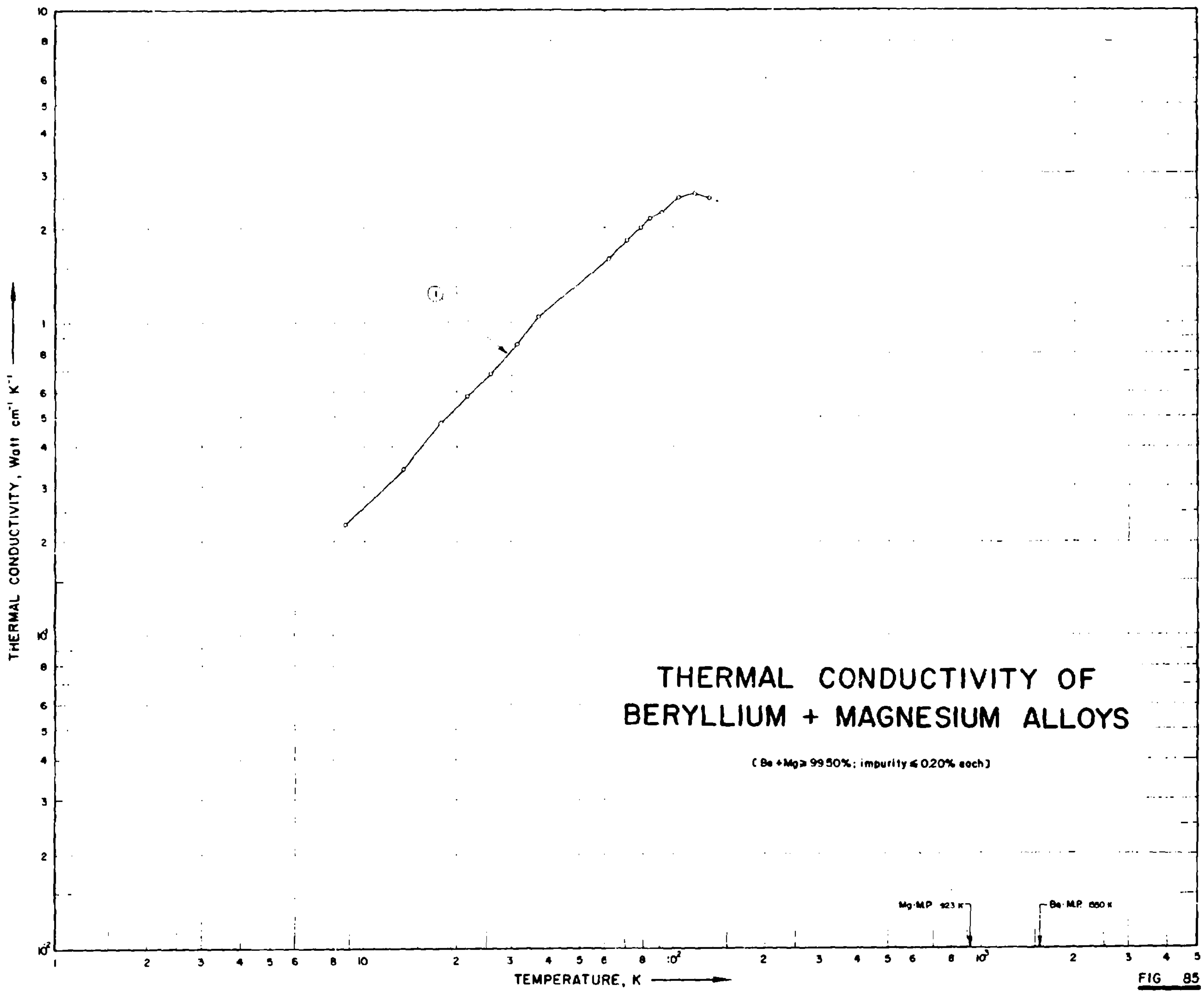

THERMAL CONDUCTIVITY OF
BERYLLIUM + MAGNESIUM ALLOYS
(Be + Mg ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Mg: M.P. 923 K
Be: M.P. 1550 K
1

FIG 85

SPECIFICATION TABLE NO. 85 THERMAL CONDUCTIVITY OF [BERYLLIUM + MAGNESIUM] ALLOYS

(Be + Mg ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 85]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Be	Mg	Composition (continued), Specifications and Remarks
1	355	L	1955	8.7-132			98	2	Composition estimated from spectrographic analysis; trace of Fe; cylindrical specimen 5 mm dia.; sintered; supplied by Brush Co.; electrical resistivity ρ(minimum) = 1.11 μ ohm cm and ρ(295 K) = 5.08 μ ohm cm.

DATA TABLE NO. 85 THERMAL CONDUCTIVITY OF [BERYLLIUM + MAGNESIUM] ALLOYS

(Be + Mg > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
8.72	0.228
13.5	0.340
17.7	0.486
21.7	0.582
25.7	0.685
31.2	0.856
36.7	1.04
61.7	1.60
71.1	1.83
78.7	1.99
84.4	2.15
91.5	2.26
104.6	2.53
117.8	2.60
131.5	2.51

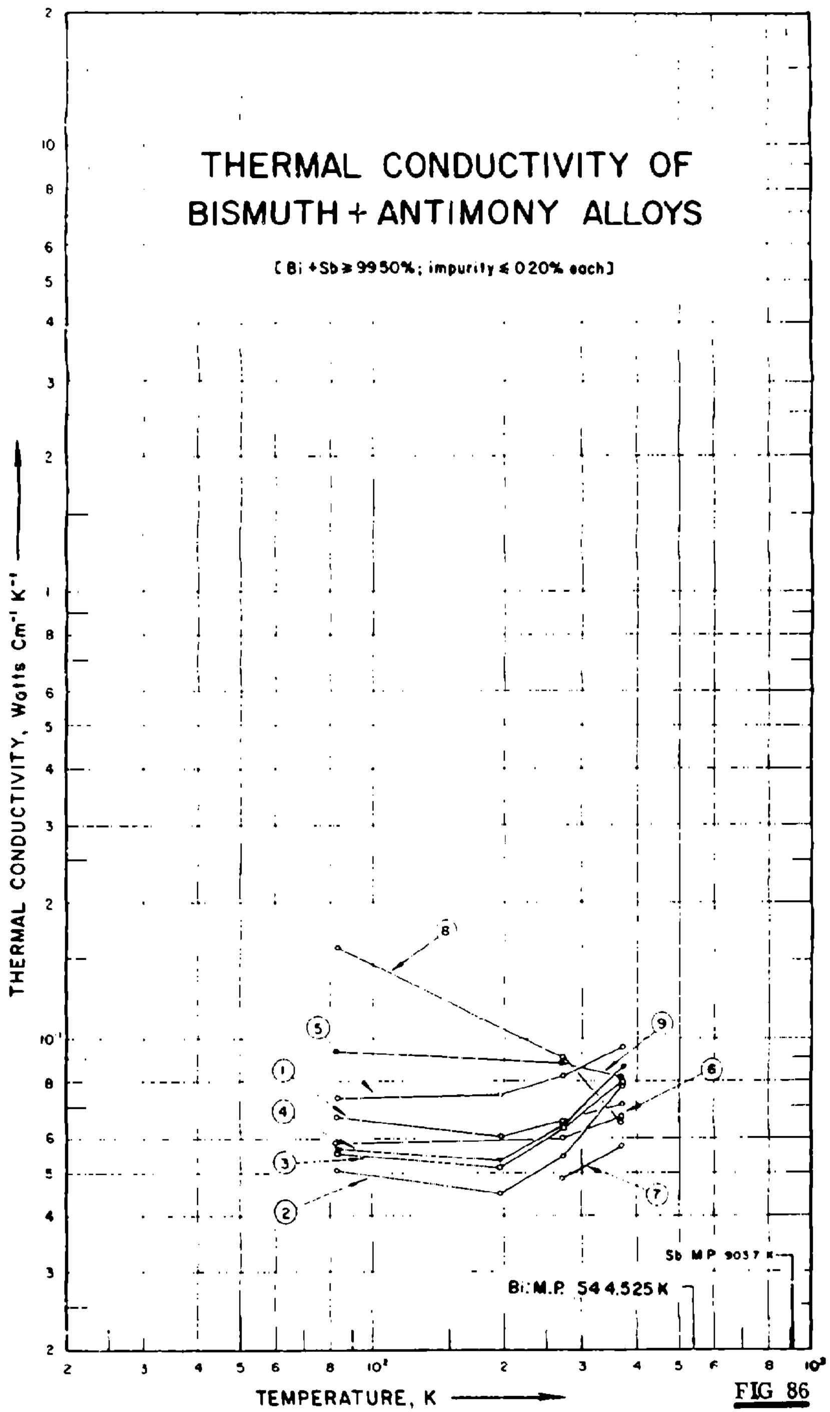

THERMAL CONDUCTIVITY OF
BISMUTH + ANTIMONY ALLOYS
[Bi + Sb ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Bi: M.P. 544.525 K
Sb M.P. 903.7 K
1
2
3
4
5
6
7
8
9

FIG 86

SPECIFICATION TABLE NO. 86 THERMAL CONDUCTIVITY OF BISMUTH - ANTIMONY ALLOYS

(Bi + Sb ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 86]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi	Sb	Composition (continued), Specifications and Remarks
1	49	L	1913	83-373			91	9	Cast; electrical conductivity 8390, 7500, 6920, and 5210 ohm^{-1} cm^{-1} at -190, -77, 0, and 100 C respectively.
2	49	L	1913	83-373			89	11	Cast; electrical conductivity 5400, 6010, 5410, and 4220 ohm^{-1} cm^{-1} at -190, -77, 0, and 100 C respectively.
3	49	L	1913	83-373			77	23	Cast; electrical conductivity 6870, 6450, 6270, and 4870 ohm^{-1} cm^{-1} at -190, -77, 0, and 100 C respectively.
4	49	L	1913	83-373			80	20	Cast; electrical conductivity 6410, 6460, 6050, and 4530 ohm^{-1} cm^{-1} at -190, -77, 0, and 100 C respectively.
5	49	L	1913	83-373			50	50	Cast; electrical conductivity 8050, 6980, 5990, and 4340 ohm^{-1} cm^{-1} at -190, -77, 0, 100 C respectively.
6	49	L	1913	83-373			95	5	Prepared by pressing chemically pure Bi and Sb powder for one hr. at 5000 Kg cm^{-2}.
7	577	L	1913	273-373			93	7	Similar to the above specimen; electrical conductivity 2000, 2800, and 3160 ohm^{-1} cm^{-1} at -190, 0, and 100 C respectively.
8	577	L	1913	83-373			89	11	Similar to the above specimen; electrical conductivity 1800, 2000, and 2100 ohm^{-1} cm^{-1} at -190, 0, and 100 C respectively.
9	577	L	1913	83-373			87	13	Similar to the above specimen; electrical conductivity 2400, 2600, and 2500 ohm^{-1} cm^{-1} at -190, 0, and 100 C respectively.

DATA TABLE NO. 86 THERMAL CONDUCTIVITY OF [BISMUTH + ANTIMONY] ALLOYS

(Bi + Sb $\geq$ 99.50%; impurity $\leq$ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts cm^{-1}K^{-1}]

T	k	T	k
CURVE 1		CURVE 8	
83.2	0.0669	83.2	0.160
196.2	0.0602	273.2	0.0904
273.2	0.0657	373.2	0.0649
373.2	0.0711		
CURVE 2		CURVE 9	
83.2	0.0506	83.2	0.0933
196.2	0.0448	273.2	0.0879
273.2	0.0548	373.2	0.0808
373.2	0.0778		
CURVE 3			
83.2	0.0552		
196.2	0.0515		
273.2	0.0632		
373.2	0.0799		
CURVE 4			
83.2	0.0561		
196.2	0.0531		
273.2	0.0636		
273.2	0.0858		
CURVE 5			
83.2	0.0732		
196.2	0.0745		
273.2	0.0820		
373.2	0.0958		
CURVE 6			
83.2	0.0582		
273.2	0.0598		
373.2	0.0669		
CURVE 7			
273.2	0.0485		
373.2	0.0573		

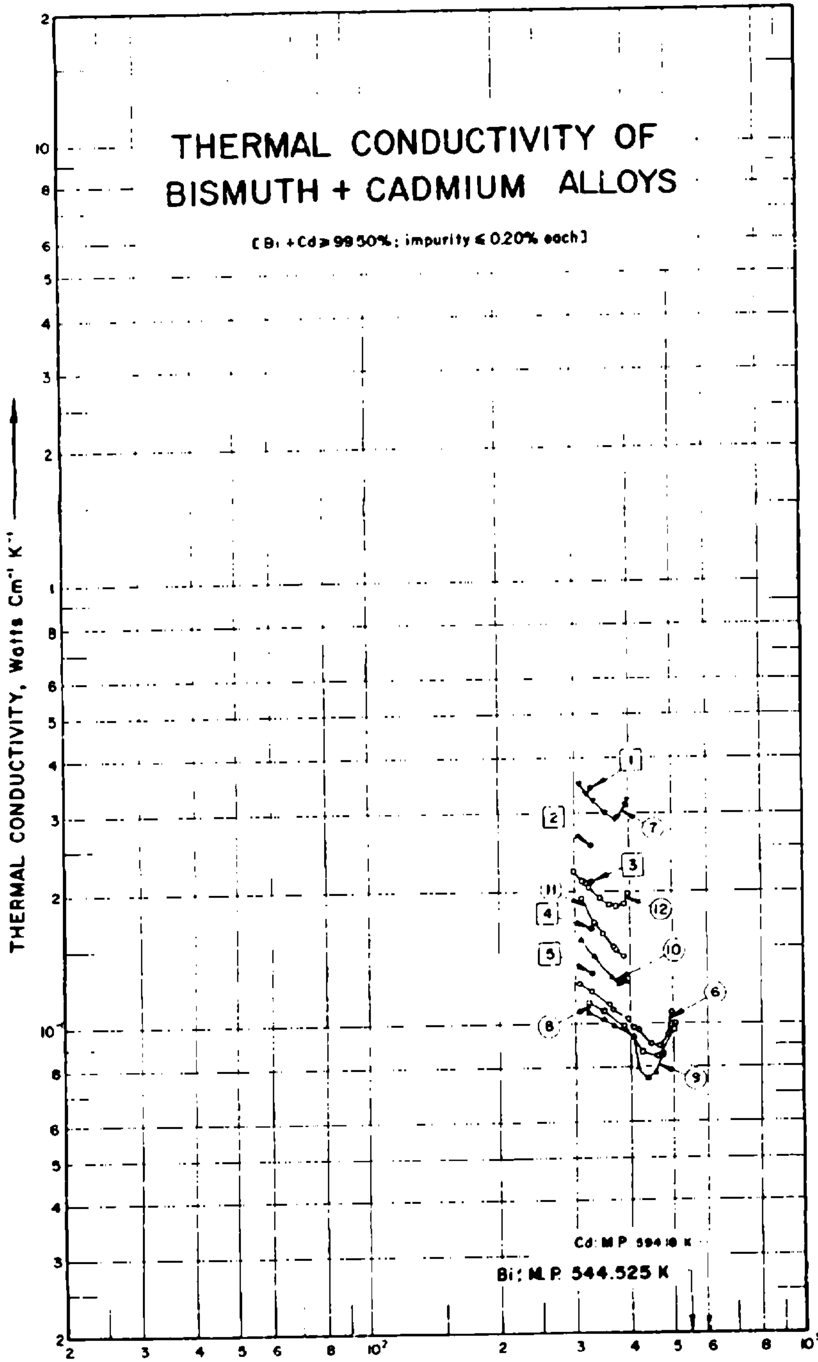

THERMAL CONDUCTIVITY OF
BISMUTH + CADMIUM ALLOYS
[Bi + Cd ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Cd: M.P. 594.18 K
Bi: M.P. 544.525 K

FIG 87

SPECIFICATION TABLE NO. 87 THERMAL CONDUCTIVITY OF [BISMUTH + CADMIUM] ALLOYS

(Bi + Cd ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 87]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi	Composition (weight percent) Cd	Composition (continued), Specifications and Remarks
1	230	L	1925	328			50	50	Approximate composition, prepared from Bi (0.03 impurity supplied by Baker) and Cd (no details reported); specimen cast and machined to 10 cm long, 1.9 cm dia.; electrical conductivity 3.51 x 10^4 ohm^{-1} cm^{-1} at 22 C.
2	230	L	1925	328			60	40	Similar to the above specimen except electrical conductivity, 2.35 x 10^4 ohm^{-1} cm^{-1} at 22 C.
3	230	L	1925	328			70	30	Similar to the above specimen except electrical conductivity, 2.13 x 10^4 ohm^{-1} cm^{-1} at 22 C.
4	230	L	1925	328			80	20	Similar to the above specimen except electrical conductivity, 1.75 x 10^4 ohm^{-1} cm^{-1} at 22 C.
5	230	L	1925	328			90	10	Similar to the above specimen except electrical conductivity, 1.36 x 10^4 ohm^{-1} cm^{-1} at 22 C.
6	383		1956	307-498			93.6	6.4	Electrical conductivity ranging from 0.891 to 0.438 x 10^4 ohm^{-1} cm^{-1} at 33.7 to 224.8 C respectively.
7	383		1956	310-397			63.2	36.8	Electrical conductivity ranging from 3.49 to 2.685 x 10^4 ohm^{-1} cm^{-1} at 36.4 to 123.9 C respectively.
8	383		1956	324-506			99.1	0.9	Electrical conductivity ranging from 0.844 to 0.458 x 10^4 ohm^{-1} cm^{-1} at 50.6 to 232.9 C respectively.
9	383		1956	321-476			95.4	4.6	Electrical conductivity ranging from 1.010 to 0.511 x 10^4 ohm^{-1} cm^{-1} at 47.8 to 202.3 C respectively.
10	383		1956	309-394			90.0	10.0	Electrical conductivity ranging from 1.229 to 0.937 x 10^4 ohm^{-1} cm^{-1} at 36.1 to 121.0 C respectively.
11	383		1956	310-387			85.3	14.7	Electrical conductivity ranging from 1.61 to 1.25 x 10^4 ohm^{-1} cm^{-1} at 37.0 to 114.2 C respectively.
12	383		1956	300-397			80.7	19.3	Electrical conductivity ranging from 1.96 to 1.54 x 10^4 ohm^{-1} cm^{-1} at 32.5 to 232.6 C respectively.

DATA TABLE NO. [illegible]7 THERMAL CONDUCTIVITY OF [BISMUTH + CADMIUM] ALLOYS

(Bi + Cd > 99.50% impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

CURVE 1

T	k
328.0	0.339

CURVE 2

T	k
328.0	0.251

CURVE 3

T	k
328.0	0.209

CURVE 4

T	k
328.0	0.163

CURVE 5

T	k
328.0	0.130

CURVE 6

T	k
306.9	0.1230
327.9	0.1180
359.1	0.1100
365.0	0.1070
395.9	0.1020
407.0	0.0975
419.1	0.0967
446.1	0.0900
468.8	0.0891
488.1	0.0946
498.0	0.1060

CURVE 7

T	k
309.6	0.0346
320.3	0.331
331.0	0.319
351.0	0.300
371.8	0.289
377.9	0.292
394.6	0.311
397.1	0.320

CURVE 8

T	k
323.8	0.1110
349.4	0.1060
351.4	0.1060
387.7	0.0987
426.5	0.0866
465.6	0.0845
473.0	0.0849
501.9	0.0967
506.1	0.1010

CURVE 9

T	k
321.0	0.106
349.2	0.102
368.5	0.0983
372.2	0.0979
408.3	0.0937
418.0	0.0795
437.0	0.0749
456.5	0.0774
472.6	0.0845
47[illegible].5	0.0858

CURVE 10

T	k
309.3	0.1548
332.0	0.1416
363.6	0.1276
379.7	0.1234
386.2	0.1247
394.2	0.1247

CURVE 11

T	k
310.2	0.192
332.2	0.168
349.0	0.159
366.7	0.149
371.9	0.147
387.4	0.142

CURVE 12

T	k
299.8	0.220
312.4	0.210
318.9	0.207
324.9	0.203
342.0	0.192
359.5	0.185
373.8	0.183
388.2	0.186
397.1	0.197

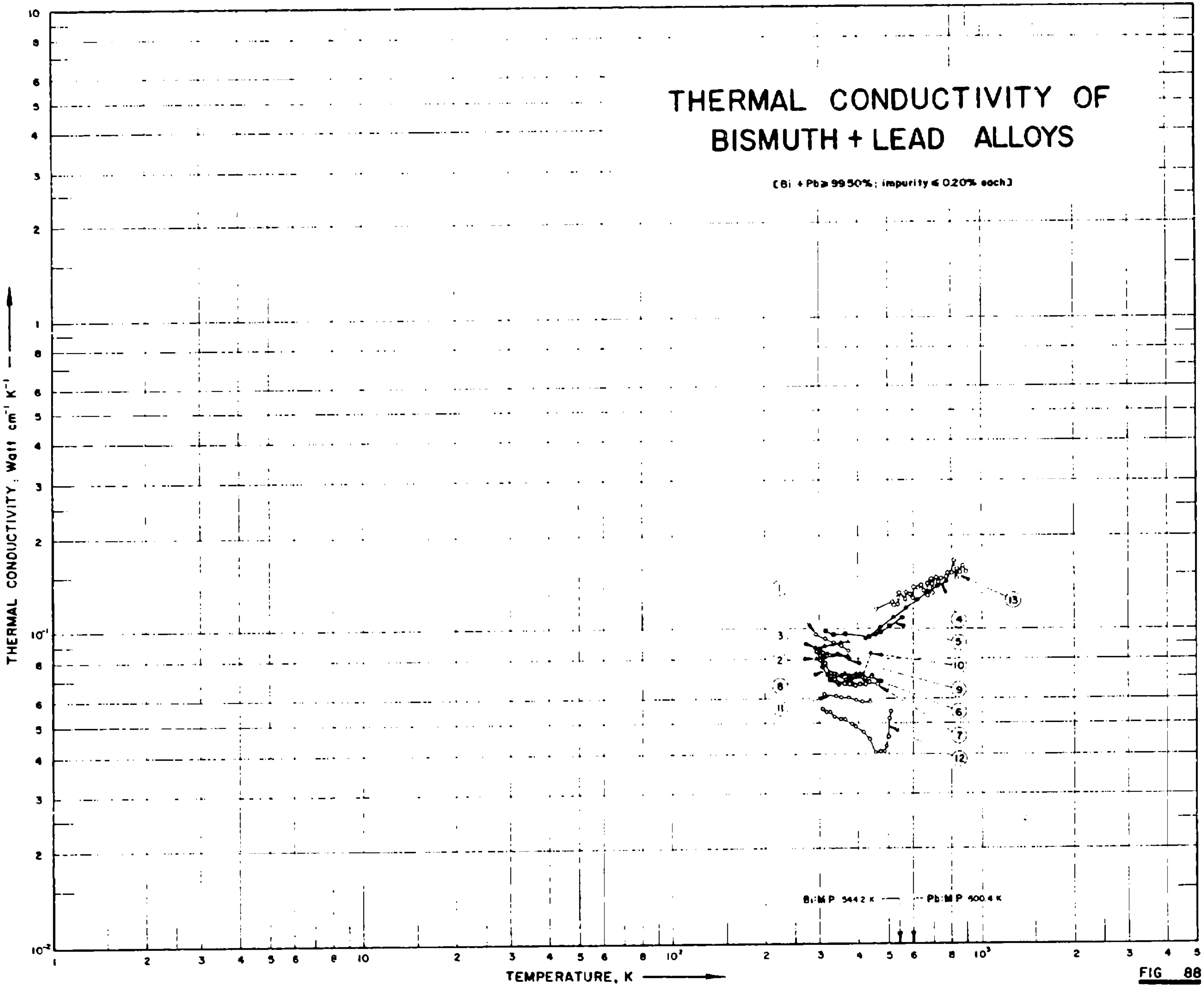

THERMAL CONDUCTIVITY OF
BISMUTH + LEAD ALLOYS
[Bi + Pb ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Bi:M.P. 544.2 K
Pb:M.P. 600.4 K
1
2
3
4
5
6
7
8
9
10
11
12
13

FIG 88

SPECIFICATION TABLE NO. 88 THERMAL CONDUCTIVITY OF (BISMUTH + LEAD) ALLOYS

(Bi + Pb > 99.50%; impurity < 0.20% each)

(For Data Reported in Figure and Table No. 88)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi	Pb	Composition (continued), Specifications and Remarks
1	126, 324	F	1955	293-373	< 7	6 B	99.15	0.85	Specimen composed of a few large crystals, prepared by fusing granular Pb and Bi in a N_2 atmosphere, casting in Pyrex tubing, and slowly cooling; electrical conductivity ranging from 4370 to 4450 $ohm^{-1} cm^{-1}$ at 293.2 to 373.2 K respectively.
2	126, 324	F	1955	293-373	< 8	8 B	98.5	1.5	Similar to the above specimen except electrical conductivity ranging from 3420 to 3666 $ohm^{-1} cm^{-1}$ at 293.2 to 373.2 K respectively.
3	126, 324	F	1955	293-373	< 6	3	97.0	3.0	Similar to the above specimen except electrical conductivity ranging from 2830 to 3040 $ohm^{-1} cm^{-1}$ at 293.2 to 373.2 K respectively.
4	113	C	1957	423-773		Bi-Pb eutectic	55.5	44.5	Eutectic composition, prepared from Pb of 99.995% purity and Bi of high purity; molten state; contained in a cavity 3.5 in. deep and 0.97 in. in dia.; stainless steel used as standard and as container; electrical resistivity ranging from 113.5 to 126.6 μ ohm cm at 150 to 500 C respectively.
5	19	L	1923	315-558		Bi-Pb eutectic	54.0	46.0	Eutectic alloy; specimen 1.5 cm dia., 12 cm long; melting point 403 K.
6	248	E	1956	295-443	± 3		99.0	1.0	
7	248	E	1956	308-466	± 3		98.5	1.5	Annealed for 48 hr. at 120 C.
8	248	E	1956	303-446	± 3		98.0	2.0	Annealed for 72 hr. at 120 C.
9	248	E	1956	303-376	± 3		66.33	33.67	
10	248	E	1956	319-441	± 3		54.56	45.44	
11	248	E	1956	311-440	± 3		95.18	4.82	
12	383		1956	307-511			98.0	2.0	Electrical conductivity ranging from 0.325 to 0.421 x 10^4 $ohm^{-1} cm^{-1}$ at 307.2 to 511.2 K respectively.
13	592	L	1959	464-902		Bi-Pb eutectic	55.5	44.5	Molten state; contained in a cavity 14.0 to 13.5 mm dia. and 140 to 210 mm long; measured in a vacuum of $\sim 4 \times 10^{-4}$ mm Hg; melting point 123.5 C; density ranging from 10.570 to 9.876 g cm^{-3} at 130 to 700 C respectively.

DATA TABLE NO. [illegible] THERMAL CONDUCTIVITY OF BISMUTH + LEAD ALLOYS

(Bi + Pb ≥ 99.80%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
293.2	0.096
313.2	0.093
333.2	0.090
353.2	0.088
373.2	0.085

CURVE 2

T	k
293.2	0.080
313.2	0.081
333.2	0.082
353.2	0.082
373.2	0.082

CURVE 3

T	k
293.2	0.087
313.2	0.088
333.2	0.089
353.2	0.090
373.2	0.091

CURVE 4

T	k
423.0	0.093
473.0	0.101
523.0	0.109
573.0	0.117
623.0	0.124
673.0	0.131
723.0	0.137
773.0	0.142

CURVE 5

T	k
315.2	0.0987
333.2	0.0978
365.2	0.0962
[illegible]	0.0943
438.2	0.0958
473.2	0.0974
509.2	0.1021
558.2	0.1080

CURVE 6

T	k
295.2	0.0841
297.2	0.0837
303.2	0.0775
329.2	0.0724
338.2	0.0707
347.2	0.0711
365.2	0.0690
371.2	0.0690
376.2	0.0690
384.2	0.0695
422.2	0.0699
443.2	0.0703

CURVE 7

T	k
308.2	0.0837
313.2	0.0774
323.2	0.0711
338.2	0.0690
363.2	0.0669
378.2	0.0662
383.2	0.0669
393.2	0.0661
408.2	0.0669
423.2	0.0669
438.2	0.0678
466.2	0.0669

CURVE 8

T	k
303.2	0.0866
308.2	0.0753
325.2	0.0690
346.2	0.0669
388.2	0.0711
422.2	0.0690
446.2	0.0711

CURVE 9

T	k
307.2	0.0837
320.2	0.0828
348.2	0.0828
376.2	0.0795

CURVE 10

T	k
319.2	0.0711
338.2	0.0711
[illegible]	0.0711
363.2	0.0720
373.2	0.0711
390.2	0.0715
403.2	0.0720
418.2	0.0735
441.2	0.0837

CURVE 11

T	k
311.2	0.0619
340.2	0.0611
354.2	0.0607
373.2	0.0602
395.2	0.0598
415.2	0.0586
440.2	0.0586

CURVE 12

T	k
307.2	0.0561
316.7	0.0544
328.6	0.0544
336.0	0.0523
353.2	0.0515
364.8	0.0515
384.6	0.0498
391.9	0.0490
418.4	0.0469
438.3	0.0448
455.5	0.0386
473.8	0.0410
489.2	0.0410
494.6	0.0427
500.2	0.0456
505.2	0.0519
512.2	0.0548

CURVE 13

T	k
464.2	0.116
524.2	0.123

CURVE 13 (cont.)

T	k
528.2	0.117
544.2	0.119
546.7	0.126
548.2	0.130
574.2	0.124
578.2	0.131
588.2	0.128
597.2	0.127
604.2	0.124
607.2	0.127
613.2	0.136
631.2	0.126
633.2	0.135
646.7	0.137
659.2	0.133
677.7	0.127
677.7	0.139
695.2	0.144
700.9	0.138
700.9	0.129
713.1	0.137
716.2	0.139
723.2	0.146
734.2	0.140
741.2	0.142
747.2	0.144
748.2	0.139
752.2	0.141
767.7	0.144
781.2	0.146
786.2	0.151
789.6	0.144
810.2	0.141
825.2	0.164
833.2	0.145
848.2	0.146
863.2	0.152
884.2	0.159
901.7	0.152

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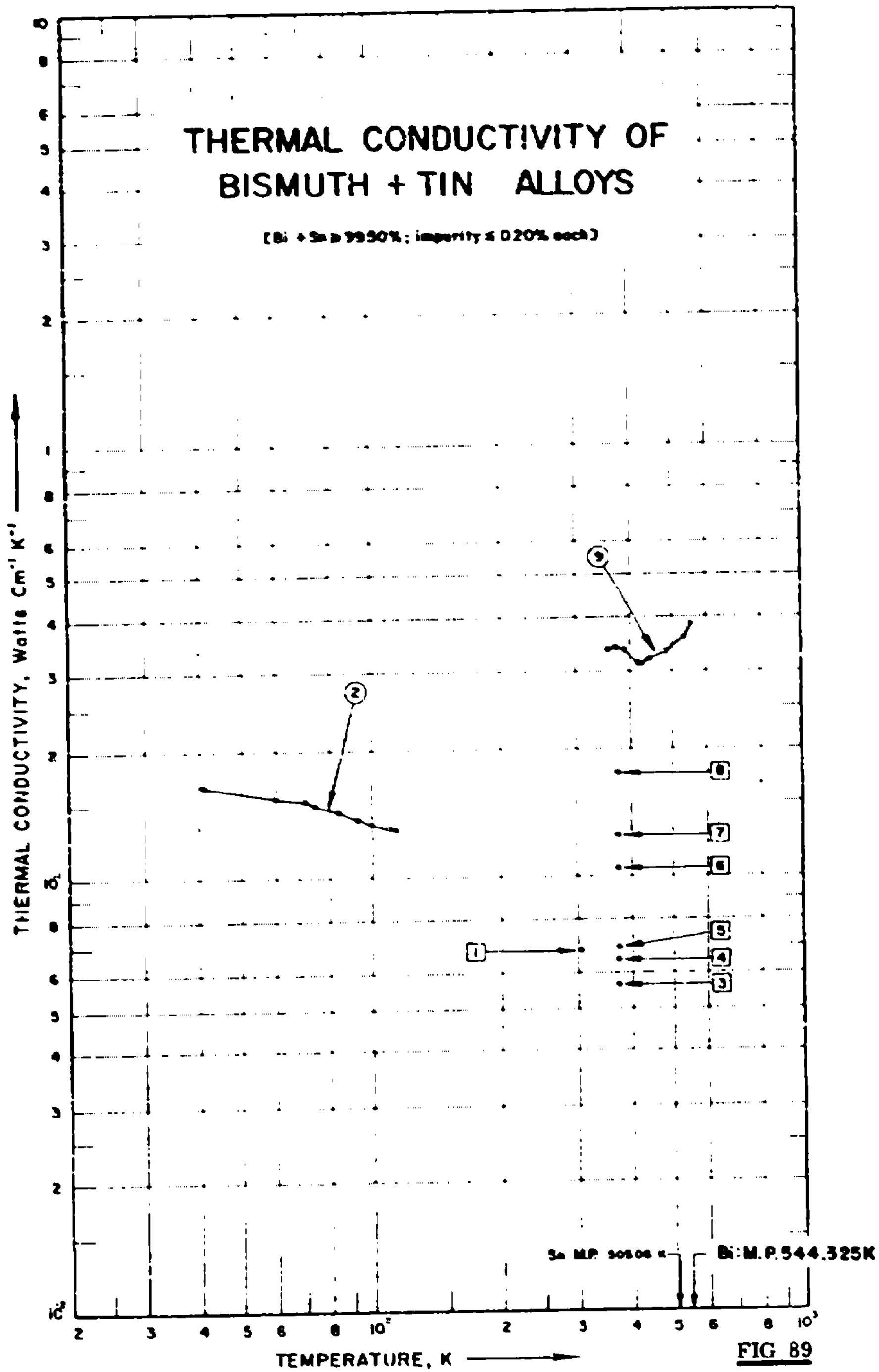

THERMAL CONDUCTIVITY OF
BISMUTH + TIN ALLOYS
[Bi + Sn ≥ 99.90%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Sn M.P. 505.08 K
Bi M.P. 544.525K
1
2
3
4
5
6
7
8
9

FIG 89

SPECIFICATION TABLE NO. 89 THERMAL CONDUCTIVITY OF [BISMUTH + TIN] ALLOYS

(Bi + Sn ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 89]

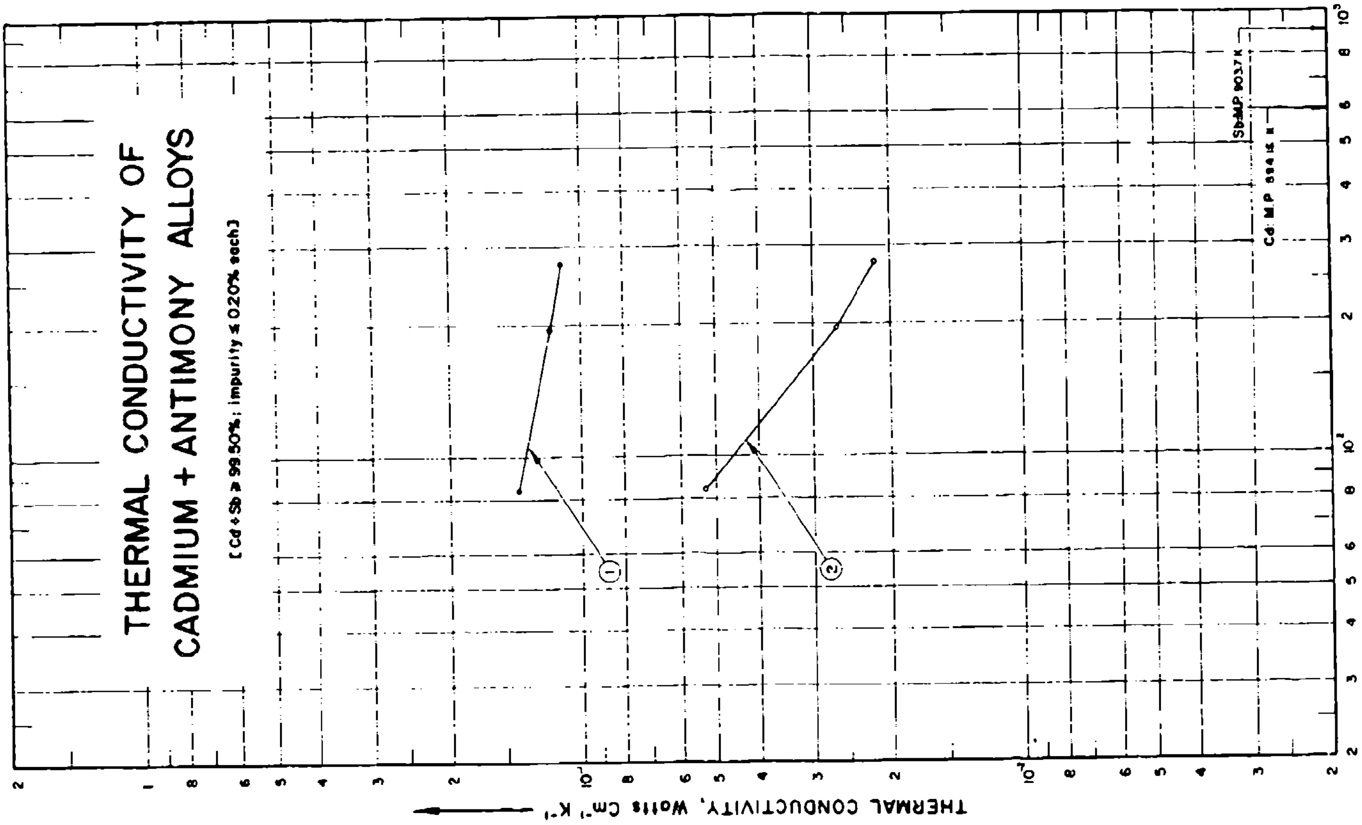
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi	Sn	Composition (continued), Specifications and Remarks
1	357	L	1943	302.2	<1.0	Hutchins' alloy	95	5	No details reported.
2	460		1957	41-114			70	30	No details reported.
3	460		1957	373.2			99.14	0.86	No details reported.
4	460		1957	373.2			97.0	3.0	No details reported.
5	460		1957	373.2			95	5	No details reported.
6	460		1957	373.2			85	15	No details reported.
7	460		1957	373.2			71	29	No details reported.
8	460		1957	373.2			59	41	No details reported.
9	514	L	1962	358-553	± 5.0		50	50	Specimen in liquid state at temperatures above 145 C.

DATA TABLE NO. 89 THERMAL CONDUCTIVITY OF [BISMUTH + TIN] ALLOYS

(Bi + Sn ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		**CURVE 9 (cont.)**	
302.2	0.0685	388.2	0.339
CURVE 2		418.2	0.314
41.0	0.165	428.2	0.314
60.0	0.155	443.2	0.322
70.5	0.152	483.2	0.335
74.0	0.149	533.2	0.360
84.0	0.144	553.2	0.385
92.5	0.138		
100.0	0.135		
110.0	0.132		
114.0	0.131		
CURVE 3			
373.2	0.0565		
CURVE 4			
373.2	0.0649		
CURVE 5			
373.2	0.0690		
CURVE 6			
373.2	0.105		
CURVE 7			
373.2	0.126		
CURVE 8			
373.2	0.176		
CURVE 9			
358.2	0.339		
373.2	0.343		



THERMAL CONDUCTIVITY OF
CADMIUM + ANTIMONY ALLOYS
[Cd + Sb ≥ 99.50%; Impurity ≤ 0.20% each]
Sb M.P. 903.7 K
Cd M.P. 594.18 K
1
2
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 90

SPECIFICATION TABLE NO. 90 THERMAL CONDUCTIVITY OF [CADMIUM + ANTIMONY] ALLOYS

(Cd + Sb ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 90]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cd	Sb	Composition (continued), Specifications and Remarks
1	35	E	1912	83-273			66.7	33.3	Calculated composition; test specimen 2-3 cm in dia.; electrical conductivity 2.69×10^3, 3.425×10^3, and 6.38×10^3 ohm^{-1} cm^{-1} at 0, -79, and -190 C respectively.
2	35	E	1912	83-273			50	50	Approx. composition; electrical conductivity 0.588×10^3 0.795×10^3, and 1.37×10^3 ohm^{-1} cm^{-1} at 0, -79, and -190 C respectively.

DATA TABLE NO. 90 THERMAL CONDUCTIVITY OF [CADMIUM + ANTIMONY] ALLOYS

(Cd + Sb ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
83.2	0.140
194.2	0.116
273.2	0.112
CURVE 2	
83.2	0.0530
194.2	0.0265
273.2	0.0217

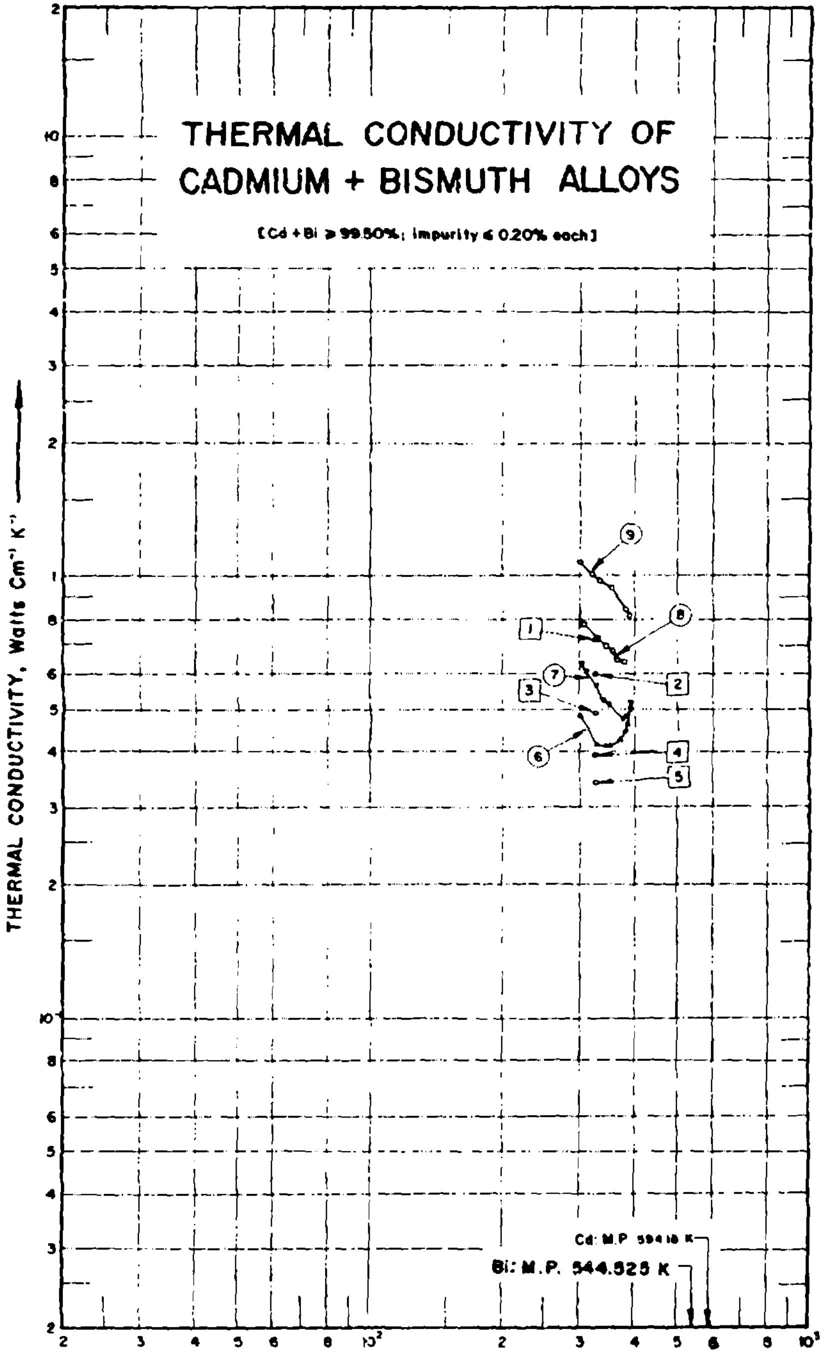

THERMAL CONDUCTIVITY OF
CADMIUM + BISMUTH ALLOYS
[Cd + Bi ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Cd: M.P. 594.18 K
Bi: M.P. 544.525 K

FIG 91

SPECIFICATION TABLE NO. 91 THERMAL CONDUCTIVITY OF [CADMIUM + BISMUTH] ALLOYS

(Cd + Bi ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 91]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cd	Bi	Composition (continued), Specifications and Remarks
1	230	L	1925	328.2			90.0	10.0	Approx. composition: Bi metal contained < 0.03 of total impurity, supplied by Baker; specimen 1.9 cm in diameter and 10 cm long, electrical conductivity 8.92×10^4 ohm^{-1} cm^{-1} 22 C.
2	230	L	1925	328.2			80.0	20.0	Similar to above specimen except electrical conductivity. 6.47×10^4 ohm^{-1} cm^{-1} at 22 C.
3	230	L	1925	328.2			70.0	30.0	Similar to above specimen except electrical conductivity. 5.24×10^4 ohm^{-1} cm^{-1} at 22 C.
4	230	L	1925	328.2			60.0	40.0	Similar to above specimen except electrical conductivity. 3.86×10^4 ohm^{-1} cm^{-1} at 22 C.
5	230	L	1925	328.2			50.0	50.0	Similar to above specimen except electrical conductivity. 3.51×10^4 ohm^{-1} cm^{-1} at 22 C.
6	383		1956	303-394			50.6	49.4	Approx. composition; electrical conductivity 4.84, 4.42, 4.255, 4.2, 4.04, 3.94, 3.905 and 3.82×10^4 ohm^{-1} cm^{-1} at 29.3, 57.4, 71.7, 79.9, 97.9, 107.9, 112.2 and 120.7 C respectively.
7	383		1956	304-396			67.7	32.3	Approx. composition; electrical conductivity 5.8, 5.68, 5.47, 5.24, 5.15, 4.85, 4.77 and 4.67×10^4 ohm^{-1} cm^{-1} at 30.7, 39.2, 55.7, 67.4, 78.1, 103.1, 113.5 and 122.9 C respectively.
8	383		1956	307-383			89.8	10.2	Approx. composition; electrical conductivity 8.45, 7.85, 7.52, 7.26, 6.95, 6.83 and 6.81×10^4 ohm^{-1} cm^{-1} at 33.8, 57.5, 72.4, 85.1, 94.2, 106.6, 109.6 C respectively.
9	383		1956	302-388			90.0	9.8	0.2 Pb; electrical conductivity 10.8, 10.11, 9.74, 8.97, 8.44 and 8.17×10^4 ohm^{-1} cm^{-1} at 28.8, 47.7, 61.4, 83.3, 105.8 and 114.9 C respectively.

DATA TABLE NO. 91 THERMAL CONDUCTIVITY OF [CADMIUM + BISMUTH] ALLOYS

(Cd + Bi ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		**CURVE 8**	
328.2	0.729	307.0	0.778
		330.7	0.7259
CURVE 2		345.6	0.699
		358.3	0.678
328.2	0.598	367.4	0.649
		379.8	0.640*
CURVE 3		382.8	0.636
328.2	0.490	**CURVE 9**	
CURVE 4		302.0	1.08
		320.9	1.01
328.2	0.393	334.6	0.975
		356.5	0.941
CURVE 5		379.0	0.845
		388.1	0.820
328.2	0.339		
CURVE 6			
302.5	0.485		
330.6	0.416		
344.9	0.413		
353.1	0.412		
371.0	0.428		
381.1	0.449		
385.4	0.464		
393.9	0.504		
CURVE 7			
303.9	0.632		
312.4	0.607		
328.9	0.565		
340.6	0.527		
351.3	0.515		
376.3	0.477		
386.7	0.485		
396.1	0.519		

* Not shown on plot

SPECIFICATION TABLE NO. 92 THERMAL CONDUCTIVITY OF [CADMIUM + THALLIUM] ALLOYS

($Cd + Tl \geq 99.50\%$; impurity $\leq 0.20\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cd	Tl	Composition (continued), Specifications and Remarks
1	230	L	1925	336.2			50.0	50.0	Specimen 5 or 6 cm long with a cross-section ~ 0.3 cm^2; electrical conductivity 0.877×10^4 $ohm^{-1} cm^{-1}$ at 23 C.
2	230	L	1925	336.2			60.0	40.0	Similar to above specimen except electrical conductivity, 0.926×10^4 $ohm^{-1} cm^{-1}$ at 23 C.
3	230	L	1925	336.2			70.0	30.0	Similar to above specimen except electrical conductivity, 1.02×10^4 $ohm^{-1} cm^{-1}$ at 23 C.
4	230	L	1925	336.2			80.0	20.0	Similar to above specimen except electrical conductivity, 1.11×10^4 $ohm^{-1} cm^{-1}$ at 23 C.
5	230	L	1925	336.2			90.0	10.0	Similar to above specimen except electrical conductivity, 1.22×10^4 $ohm^{-1} cm^{-1}$ at 23 C.

DATA TABLE NO. 92 THERMAL CONDUCTIVITY OF [CADMIUM + THALLIUM] ALLOYS

($Cd + Tl \geq 99.50\%$; impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 4*	
336.2	0.661	336.2	0.799
CURVE 2*		CURVE 5*	
336.2	0.703	336.2	0.866
CURVE 3*			
336.2	0.753		

* No graphical presentation

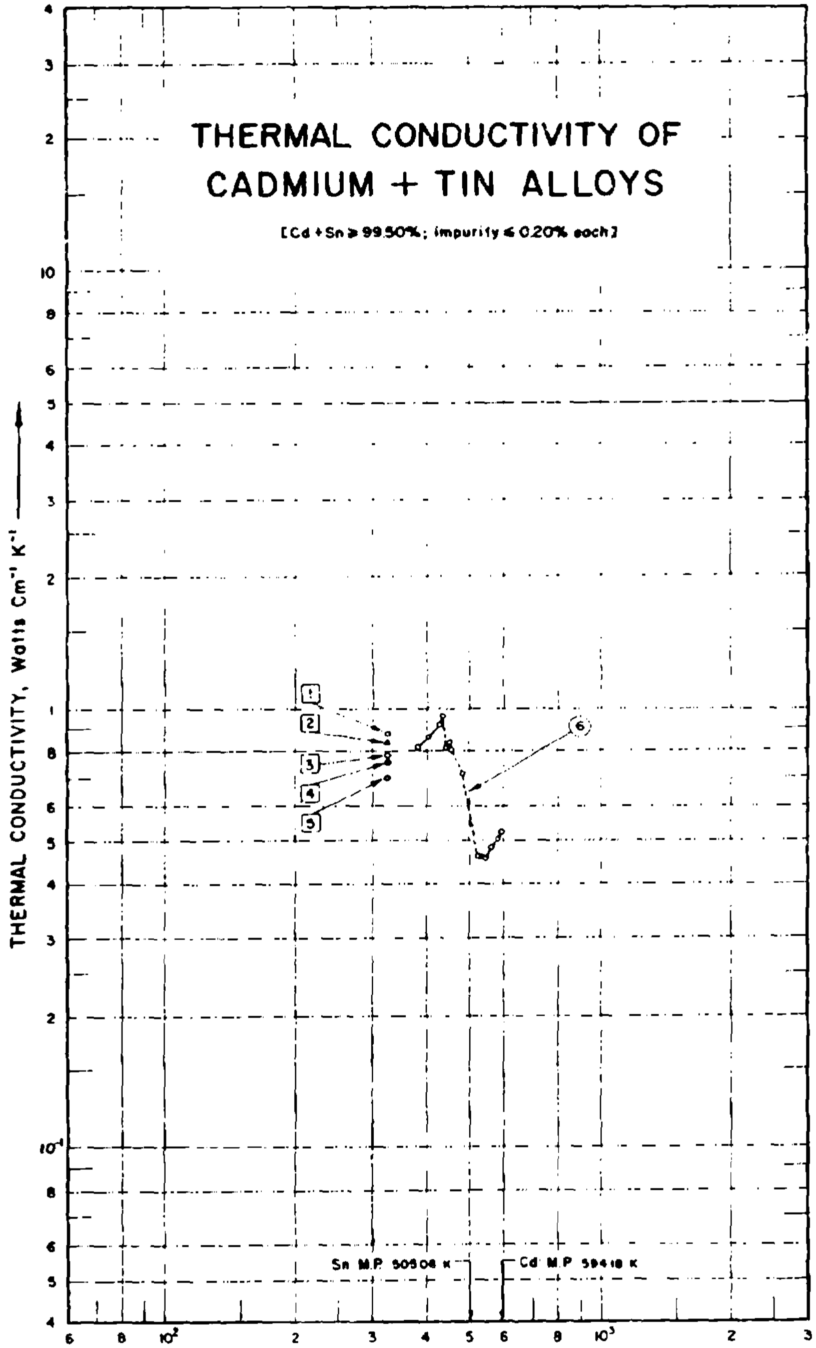

THERMAL CONDUCTIVITY OF
CADMIUM + TIN ALLOYS
[Cd + Sn ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Sn M.P. 505.04 K
Cd M.P. 594.18 K
1
2
3
4
5
6

FIG 93

SPECIFICATION TABLE NO. 93 THERMAL CONDUCTIVITY OF [CADMIUM - TIN] ALLOYS

(Cd + Sn > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 93]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cd	Sn	Composition (continued), Specifications and Remarks
1	230	L	1925	326.2			90.0	10.0	Approx. composition; < 0.03 of total impurity in Baker's analyzed tin; specimen 1.9 cm in diameter and 10 cm long, electrical conductivity 12.7×10^4 ohm^{-1} cm^{-1} at 22 C.
2	230	L	1925	326.2			80.0	20.0	Similar to above specimen except electrical conductivity, 12.3×10^4 ohm^{-1} cm^{-1} at 22 C.
3	239	L	1925	326.2			[illegible]	30.0	Similar to above specimen except electrical conductivity, 11.4×10^4 ohm^{-1} cm^{-1} at 22 C.
4	230	L	1925	326.2			60.0	40.0	Similar to above specimen except electrical conductivity, 10.7×10^4 ohm^{-1} cm^{-1} at 22 C.
5	230	L	1925	326.2			50.0	50.0	Similar to above specimen except electrical conductivity, 9.98×10^4 ohm^{-1} cm^{-1} at 22 C.
6	514	L	1962	383-591	< 5.0		70.0	29.7	Specimen in liquid state at temperatures > 548 K.

DATA TABLE NO. 93 THERMAL CONDUCTIVITY OF [CADMIUM + TIN] ALLOYS

(Cd + Sn ≥99.50%; impurity < 0.20% each

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
326.2	0.875
CURVE 2	
326.2	0.837
CURVE 3	
326.2	0.782
CURVE 4	
326.2	0.753
CURVE 5	
326.2	0.699
CURVE 6	
383.2	0.816
403.2	0.856
428.2	0.912
432.2	0.962
443.2	0.816
453.2	0.837
457.2	0.803
483.2	0.711
523.2	0.460
533.2	0.460
548.2	0.455
563.2	0.481
583.2	0.502
591.2	0.523

SPECIFICATION TABLE NO. 94 THERMAL CONDUCTIVITY OF [CADMIUM + ZINC] ALLOYS

(Cd + Zn > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cd	Zn	Composition (continued), Specifications and Remarks
1	230	L	1925	326.2			90.0	10.0	Approx composition: <0.03 of total impurity in Baker's analyzed Zn; specimen 1.5 cm in dia and 10 cm long; electrical conductivity 13.91 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
2	230	L	1925	326.2			80.0	20.0	Similar to above specimen except electrical conductivity, 14.1 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
3	230	L	1925	326.2			70.0	30.0	Similar to above specimen except electrical conductivity, 14.4 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
4	230	L	1925	326.2			60.0	40.0	Similar to above specimen except electrical conductivity, 14.7 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.

DATA TABLE NO. 94 THERMAL CONDUCTIVITY OF [CADMIUM + ZINC] ALLOYS

(Cd + Zn > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
326.2	0.954
CURVE 2*	
326.2	0.967
CURVE 3*	
326.2	0.996
CURVE 4*	
326.2	1.021

* No graphical presentation

SPECIFICATION TABLE NO. 95 THERMAL CONDUCTIVITY OF (CHROMIUM + NICKEL) ALLOYS

(Cr + Ni > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cr	Ni	Composition (continued), Specifications and Remarks
1	230	L	1925	329.2			50.0	50.0	Approx. composition; specimen ~ 5 cm long with cross-section 0.3 cm²; made from nickel 99.75 to 99.85 pure including cobalt, trace Fe and Cu, supplied by International Nickel Co. of America, fused with Cr supplied by Eimer and Amend; electrical conductivity 0.83 x 10^3 $ohm^{-1}cm^{-1}$ at 22 C.

DATA TABLE NO. 95 THERMAL CONDUCTIVITY OF (CHROMIUM + NICKEL) ALLOYS

(Cr + Ni > 99.50%; impurity ≤ 0.20% each)

[Temperature, T,K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
329.2	0.117

* No graphical presentation

SPECIFICATION TABLE NO. 96 THERMAL CONDUCTIVITY OF [COBALT + CARBON] ALLOYS

(Co + C ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Co	C	Composition (continued), Specifications and Remarks
1	238	E	1927	303.2			~99.46	0.22	0.20 Fe, 0.003 P, 0.034 S, 0.032 Si, 0.05 Al, trace Mn and Ni; Co supplied by Sugibayasi & Co.; specimen 5 mm in dia and 20 cm long; cast and machined; heated 40 min at 800 C and slowly cooled.

DATA TABLE NO. 96 THERMAL CONDUCTIVITY OF [COBALT + CARBON] ALLOYS

(Co + C ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
303.2	0.544

* No graphical presentation

SPECIFICATION TABLE NO. 97 THERMAL CONDUCTIVITY OF [COBALT + CHROMIUM] ALLOYS

(Co + Cr > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Co	Cr	Composition (continued), Specifications and Remarks
1	230	L	1925	332.2			90.0	10.0	Alloy made from Cr (pure and free from C) and Co both supplied by Eimer and Amend; specimen ~ 5 cm long with a cross section of 0.3 cm^2; electrical conductivity 1.78 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
2	230	L	1925	332.2			70.0	30.0	Similar to above specimen except electrical resistivity, 1.26 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.
3	230	L	1925	332.2			60.0	40.0	Similar to above specimen except electrical resistivity, 1.09 x 10^4 $ohm^{-1}cm^{-1}$ at 22 C.

DATA TABLE NO. 97 THERMAL CONDUCTIVITY OF [COBLAT + CHROMIUM] ALLOYS

(Co + Cr > 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
332.2	0.142
CURVE 2*	
332.2	0.130
CURVE 3*	
332.2	0.105

* No graphical presentation

SPECIFICATION TABLE NO. 98 THERMAL CONDUCTIVITY OF (COBLAT + NICKEL) ALLOYS

(Co + Ni > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Co	Ni	Composition (continued), Specifications and Remarks
1	238	E	1927	303.2			50	50	The alloy made from Ni (containing impurities 0.1 Fe, 0.037 C, 0.019 S, 0.006 Si, 0.013 Cu, trace P, Al and Mn) and Cobalt (containing 0.2 Fe, 0.22 C, 0.003 P, 0.034 S, 0.032 Si, 0.05 Al, trace Ni, Mn and Cu); specimen 5 mm in dia and 20 cm long; cast and machined, then heated for 40 min at 800 C and slowly cooled; electrical resistivity 1.373 x 10^{5} ohm cm at 30 C.
2	238	E	1927	303.2			60	40	The alloy made from the same materials as above; specimen similarly prepared; electrical resistivity 1.333 x 10^{5} ohm cm at 30 C.
3	238	E	1927	303.2			70	30	The alloy made from the same materials as above; specimen similarly prepared; electrical resistivity 1.233 x 10^{-5} ohm cm at 30 C.
4	238	E	1927	303.2			75	25	The alloy made from the same materials as above; specimen similarly prepared; electrical resistivity 1.162 x 10^{5} ohm cm at 30 C.
5	238	E	1927	303.2			80	20	The alloy made from the same materials as above; specimen similarly prepared; electrical resistivity 1.206 x 10^{-5} ohm cm at 30 C.
6	238	E	1927	303.2			85	15	The alloy made from the same materials as above; specimen similarly prepared; electrical resistivity 1.38 x 10^{-5} ohm cm at 30 C.
7	238	E	1927	303.2			90	10	The alloy made from the same materials as above; specimen similarly prepared; electrical resistivity 1.331 x 10^{-5} ohm cm at 30 C.
8	238	E	1927	303.2			95	5	The alloy made from the same materials as above; specimen similarly prepared; electrical resistivity 1.294 x 10^{-5} ohm cm at 30 C.

DATA TABLE NO. 98 THERMAL CONDUCTIVITY OF (COBALT + NICKEL) ALLOYS

(Co + Ni ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
303.2	0.506
CURVE 2*	
303.2	0.523
CURVE 3*	
303.2	0.556
CURVE 4*	
303.2	0.573
CURVE 5*	
303.2	0.556
CURVE 6*	
303.2	0.527
CURVE 7*	
303.2	0.510
CURVE 8*	
303.2	0.523

* No graphical presentation

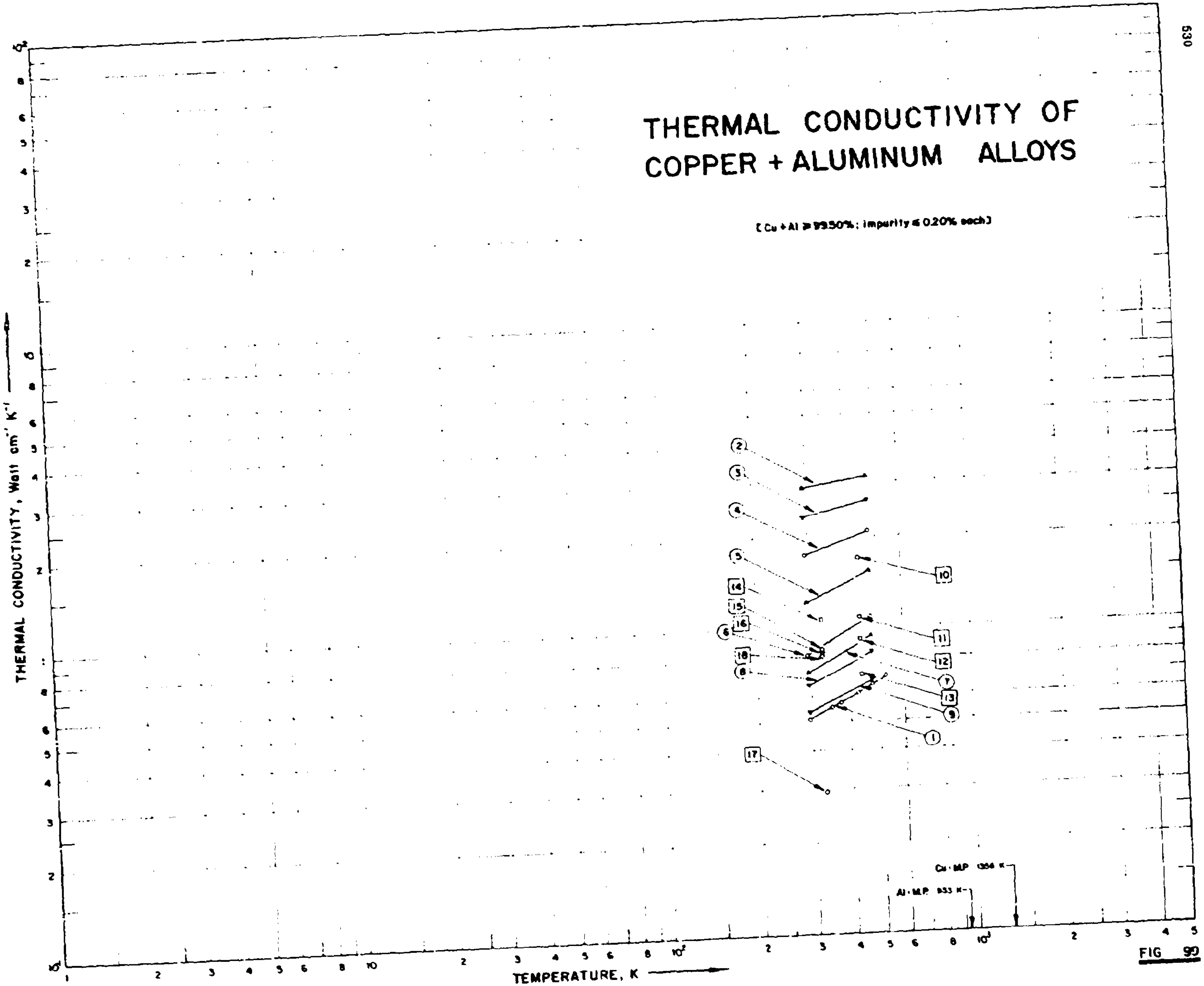

THERMAL CONDUCTIVITY OF
COPPER + ALUMINUM ALLOYS
[Cu + Al ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Cu: M.P. 1356 K
Al: M.P. 933 K

FIG 99

SPECIFICATION TABLE NO. 99 THERMAL CONDUCTIVITY OF [COPPER + ALUMINUM] ALLOYS

(Cu + Al > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 99]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Al	Composition (continued), Specifications and Remarks
1	55	L	1928	293-523		Aluminum bronze; 6	90.0	10.0	Approx. composition; specimen 2.53 cm in diameter and 38 cm long; chill-cast and annealed; electrical resistivity reported at 293, 348, 373, 423, 473 and 523 C respectively as 14.7, 15.6, 16.0, 16.7, 17.5 and 18.3 μ ohm cm.
2	135	L	1935	293, 473		100	99.77	0.22	0.01 Fe; specimen 0.75 in. in diameter and 8 in. long; rolled and annealed at 750 C for 2 hrs.; electrical conductivity reported at 20 and 200 C respectively as 41.91 x 10^4 and 27.59 x 10^4 ohm^{-1} cm^{-1}.
3	135	L	1935	293, 473		101	99.47	0.47	0.02 Fe; similar to above specimen; electrical conductivity reported at 20 and 200 C respectively as 32.10 x 10^4 and 22.91 x 10^4 ohm^{-1} cm^{-1}.
4	135	L	1935	293, 473		76	99.20	0.71	0.09 Fe; similar to above specimen; electrical conductivity reported at 20 and 200 C respectively as 23.40 x 10^4 and 17.95 x 10^4 ohm^{-1} cm^{-1}.
5	135	L	1935	293, 473		77	98.08	1.89	0.03 Fe, similar to above specimen except annealed at 700 C; electrical conductivity reported at 20, 200 C respectively as 15.91 x 10^4 and 13.00 x 10^4 ohm^{-1} cm^{-1}.
6	135	L	1935	293, 473		45	95.25	4.61	0.14 Fe; similar to above specimen; annealed at 700 C for 2 hrs.; electrical conductivity reported at 20, 200 C respectively as 10.26, 8.824 x 10^4 ohm^{-1} cm^{-1}.
7	135	L	1935	293, 473		46	92.15	7.72	0.13 Fe; specimen 0.75 in. in diameter and 8 in. long; rolled and annealed at 750 C for 3 1/2 hrs.; slowly cooled in furnace; electrical conductivity reported at 20 and 200 C respectively as 8.834 and 7.65 x 10^4 ohm^{-1} cm^{-1}.
8	135	L	1935	293, 473		102	90.56	9.37	0.07 Fe; similar to the above specimen; annealed at 750 C for 2 hrs. and very slowly cooled in furnace at 450 C for 18 hrs.; electrical conductivity reported at 20 and 200 C respectively as 8.24 and 7.056 x 10^4 ohm^{-1} cm^{-1}.
9	135	L	1935	293, 473		130	87.76	12.15	0.09 Fe; similar to the above specimen except electrical conductivity reported at 20 and 200 C respectively as 6.925 and 5.738 x 10^4 ohm^{-1} cm^{-1}.
10	67	L	1932	438.2			98.25	≈1.75	Specimen prepared from Al (containing 0.21 Fe, 0.29 Si) and high grade Cu; cast in iron mould 7 in. long and 9/16 in. in diameter, specimen 6 1/2 in. long and 1/2 in. in diameter; annealed at 500 C.

SPECIFICATION TABLE NO. 99 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Al	Composition (continued), Specifications and Remarks
11	67	L	1932	438.2			94.90	$\approx$5.10	Similar to the above specimen.
12	67	L	1932	438.2			91.55	$\approx$8.45	Similar to the above specimen.
13	67	L	1932	438.2			87.22	$\approx$12.78	Similar to the above specimen.
14	230	L	1925	326.2			50.0	50.0	Approx. composition; total impurity <0.03 in each metal, specimen 1.9 cm in diameter and 10 cm long; supplied by Baker; electrical conductivity 15.3 x 10^4 ohm^{-1} cm^{-1} at 23 C.
15	230	L	1925	326.2			60.0	40.0	Similar to the above specimen; except electrical conductivity 10.6 x 10^4 ohm^{-1} cm^{-1} at 23 C.
16	230	L	1925	326.2			70.0	30.0	Similar to the above specimen; except electrical conductivity 9.76 x 10^4 ohm^{-1} cm^{-1} at 23 C.
17	230	L	1925	326.2			80.0	20.0	Similar to the above specimen except electrical conductivity 3.60 x 10^4 ohm^{-1} cm^{-1} at 23 C.
18	230	L	1925	326.2		Aluminum bronze	90.0	10.0	Similar to the above specimen except electrical conductivity 9.98 x 10^4 ohm^{-1} cm^{-1} at 23 C.

DATA TABLE NO. 99 THERMAL CONDUCTIVITY OF [COPPER + ALUMINUM] ALLOYS

(Cu + Al ≥99.50%; impurity ≤0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
293.2	0.510
348.2	0.552
373.2	0.573
423.2	0.415
473.2	0.653
523.2	0.695
CURVE 2	
293.2	2.912
473.2	3.113
CURVE 3	
293.2	2.347
473.2	2.607
CURVE 4	
293.2	1.749
473.2	2.084
CURVE 5	
293.2	1.226
473.2	1.544
CURVE 6	
293.2	0.828
473.2	1.071
CURVE 7	
293.2	0.724
473.2	0.937
CURVE 8	
293.2	0.653
473.2	0.837

T	k
CURVE 9	
293.2	0.536
473.2	0.674
CURVE 10	
438.2	1.695
CURVE 11	
438.2	1.071
CURVE 12	
438.2	0.916
CURVE 13	
438.2	0.707
CURVE 14	
326.2	1.059
CURVE 15	
326.2	0.753
CURVE 16	
326.2	0.745
CURVE 17	
326.2	0.292
CURVE 18	
326.2	0.816

SPECIFICATION TABLE NO. 100 THERMAL CONDUCTIVITY OF [COPPER + ANTIMONY] ALLOYS

(Cu + Sb > 99.50%; Impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Sb	Composition (continued), Specifications and Remarks
1	319, 320	P	1966	1073.2	8		50	50	Molten specimen contained in a thin-walled stainless steel cylindrical crucible of dimensions 24 mm dia x 100 mm long; electrical resistivity reported as 138 and 153 μ ohm cm at 700 and 800 C, respectively; thermal conductivity values calculated from the thermal diffusivity and the specific heat measurements using the density data from Bienias, A and Sauerwald, F., Z. anorg. chem., 41, 51, 1927.

DATA TABLE NO. 100 THERMAL CONDUCTIVITY OF [COPPER + ANTIMONY] ALLOYS

(Cu + Sb > 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
1073.2	0.236

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* No graphical presentation

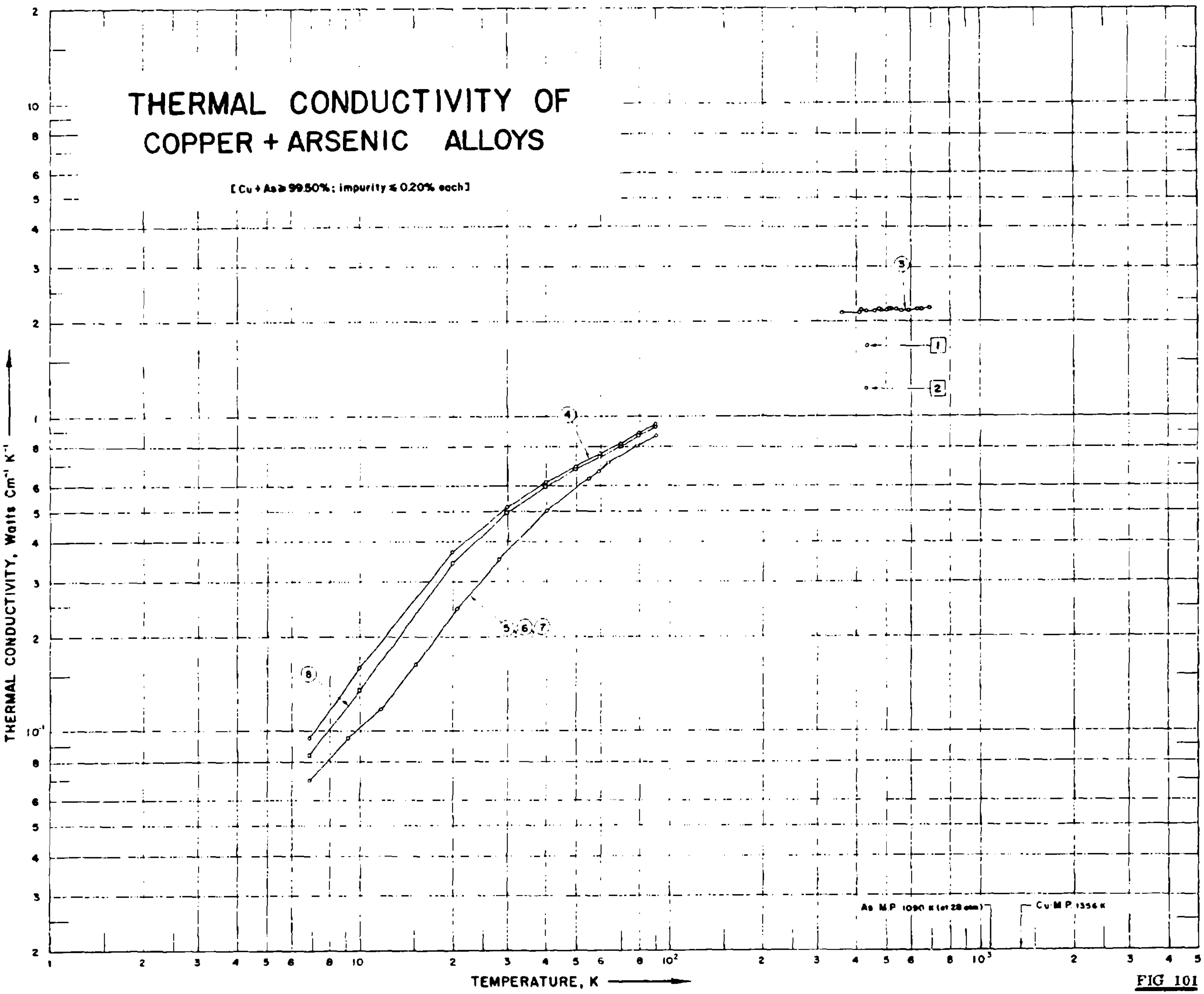

THERMAL CONDUCTIVITY OF
COPPER + ARSENIC ALLOYS
[Cu + As ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
As M.P. 1090 K (at 28 atm)
Cu M.P. 1356 K
1
2
3
4
5, 6, 7
8

FIG 101

SPECIFICATION TABLE NO. 101 THERMAL CONDUCTIVITY OF COPPER + ARSENIC ALLOYS

(Cu + As ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 101]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	As	Composition (continued), Specifications and Remarks
1	67	L	1932	438.2			99.698	0.302	High grade copper bar with traces impurities; specimen 6.5 in. long and 0.5 in. in diameter; cast and machined; thermal conductivity data obtained from the mean value of 16 readings.
2	67	L	1932	438.2			99.505	0.495	Similar to the above specimen.
3	30	L	1925	363-694	±2.6		99.53	0.389	0.022 Ni, 0.003 Sb, Nil Sn and Pb; specimen 15.5 in. long and 0.75 in. in diameter; supplied by Birmingham Battery and Metal Co.; rolled, drawn and annealed.
4	236	L	1959	6.9-90		No. 0	99.55	0.35	0.05 P; specimen 3.25 mm in diameter and 8 cm long, drawn and then prolongedly annealed at 450 C.
5	236	L	1959	6.9-91		No. 1	99.55	0.35	0.05 P; similar to above specimen; drawn, prolongedly annealed at 450 C and then severely deformed torsionally.
6	236	L	1959	6.9-91		No. 2	99.55	0.35	0.05 P; the above specimen annealed in helium as temp. increased up to 175 C at a rate of 6 C per min.
7	236	L	1959	6.9-91		No. 3	99.55	0.35	0.05 P; the above specimen again annealed in helium as temp. increased up to 275 C at a rate of 6 C per min.
8	236	L	1959	6.9-90		No. 4	99.55	0.35	0.05 P; the above specimen again annealed in helium as temp. increased up to 450 C at a rate of 6 C per min.

DATA TABLE NO. 101 THERMAL CONDUCTIVITY OF [COPPER + ARSENIC] ALLOYS

(Cu + As ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

CURVE 1

T	k
433.2	1.665

CURVE 2

T	k
428.2	1.222

CURVE 3

T	k
363.2	2.142
413.2	2.142
415.2	2.167
434.2	2.155
462.7	2.163
478.2	2.184
485.2	2.167
504.7	2.172
515.7	2.192
521.2	2.192
542.2	2.188
565.7	2.163
594.7	2.167
633.2	2.188
657.2	2.192
693.7	2.205

CURVE 4

T	k
6.9	0.0947
10.0	0.159
20.0	0.371
30.0	0.517
40.0	0.618
50.0	0.695
60.0	0.762
70.0	0.820
80.0	0.889
90.0	0.947

CURVE 5

T	k
6.9	0.0700
9.2	0.0947
11.7	0.118
15.3	0.163
20.7	0.245
28.3	0.351
40.5	0.502
55.1	0.638
59.1	0.670
64.1	0.712
79.3	0.805
91.3	0.872

CURVE 6

T	k
6.9	0.0700
9.2	0.0947
11.7	0.118
15.3	0.163
20.7	0.245
28.3	0.351
40.5	0.502
55.1	0.638
59.1	0.670
64.1	0.712
79.3	0.805
91.3	0.872

CURVE 7

T	k
6.9	0.0700
9.2	0.0947
11.7	0.118
15.3	0.163
20.7	0.245
28.3	0.351
40.5	0.502
55.1	0.638
59.1	0.670
64.1	0.712
79.3	0.805
91.3	0.872

CURVE 8

T	k
6.9	0.0841
10.0	0.135
20.0	0.344
30.0	0.497
40.0	0.597
50.0	0.684
60.0	0.744
70.0	0.809
80.0	0.871
90.0	0.927

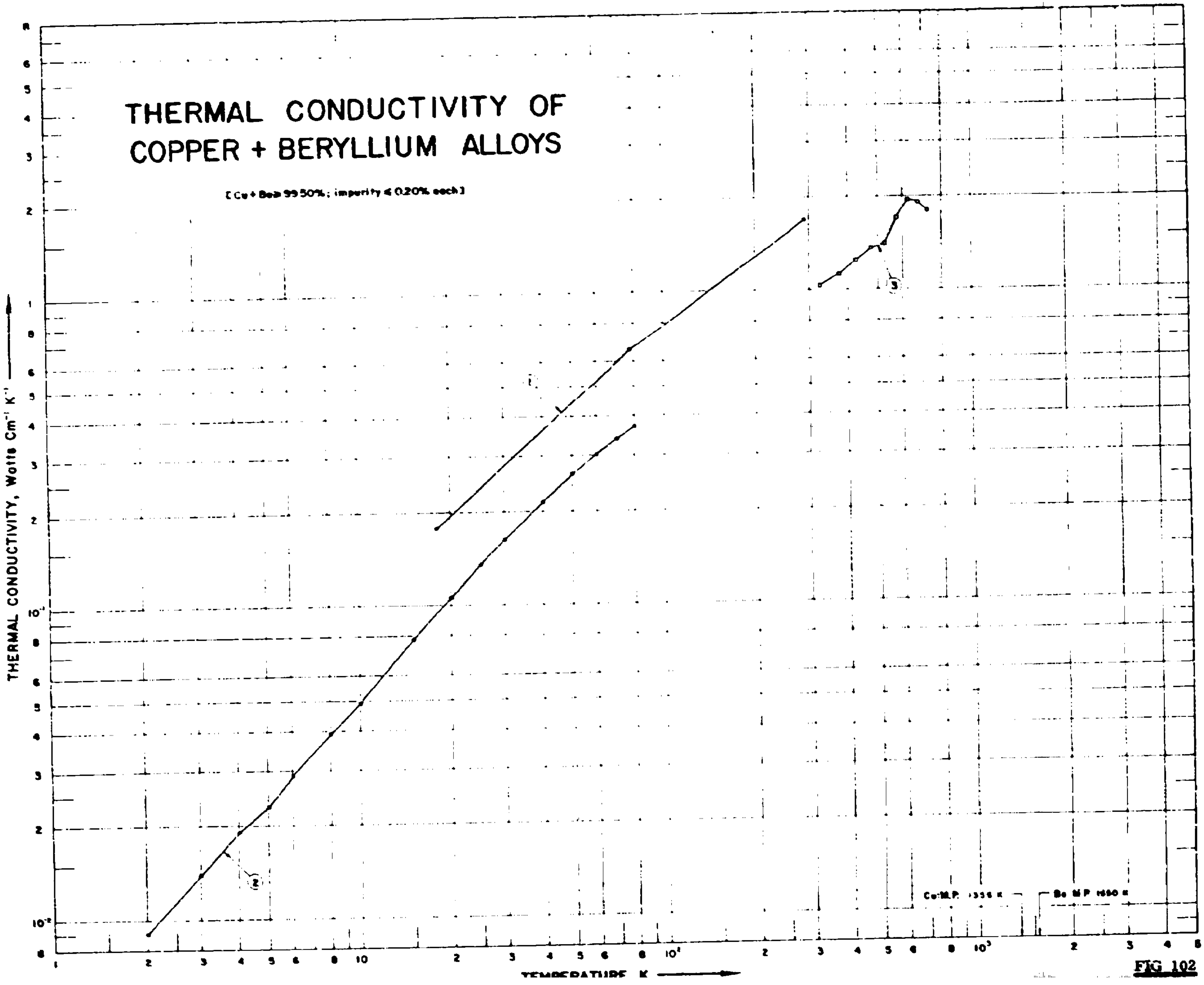

THERMAL CONDUCTIVITY OF
COPPER + BERYLLIUM ALLOYS
[Cu + Be ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3

FIG 102

SPECIFICATION TABLE NO. 102 THERMAL CONDUCTIVITY OF (COPPER + BERYLLIUM) ALLOYS

(Cu + Be ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 102]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Be	Composition (continued), Specifications and Remarks
1	193	L	1939	18-290		Beryllium Bronze	98.49	1.50	0.01 Fe; specimen ~4.97 mm in diameter and 32 mm long; heated at 400 C for 3 hrs. and cooled slowly.
2	229	L	1955	2.0-80		Beryllium Copper	98.0	2.0	Approx. composition; heated at 300 C for 2 hrs.; electrical resistivity 8.25, 6.2 and 5.54 x 10^{-6} ohm cm at room temp. 77 and 4.2 K respectively.
3	338	L	1933	323-723			97.55	2.45	Approx. composition; specimen machined from a cast bar; heated to 1450 F for 1 hour and quenched in cold water, hardened at 570 F and air cooled.

DATA TABLE NO. 102 THERMAL CONDUCTIVITY OF [COPPER + BERYLLIUM] ALLOYS

(Cu + Be ≥ 99.50%; Impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
18	0.177
78	0.653
290	1.700
CURVE 2	
2	0.009
3	0.014
4	0.019
5	0.023
6	0.029
8	0.039
10	0.049
15	0.078
20	0.107
25	0.135
30	0.162
40	0.215
50	0.262
60	0.304
70	0.340
80	0.371
CURVE 3	
323.2	1.046
373.2	1.130
423.2	1.255
473.2	1.380
523.2	1.420
573.2	1.715
623.2	1.966
673.2	1.925
723.2	1.80

SPECIFICATION TABLE NO. 103 THERMAL CONDUCTIVITY OF [COPPER + CADMIUM] ALLOYS

(Cu + Cd > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Cd	Composition (continued), Specifications and Remarks
1	135	L	1935	293,473		Bar 134	>99.21	0.85	0.009 Si, 0.007 Fe; specimen 0.75 in. in dia and 8 in. long; supplied by American Brass Co.; rolled, annealed and cold drawn then heated at 700 C for 2 hrs; electrical conductivity 50.561 and 31.19 x 10^4 $ohm^{-1}cm^{-1}$ at 20 and 200 C respectively.
2	135	L	1935	293,473		Bar 69	>99.04	0.90	0.07 Fe; similar to above specimen except heated at 750 C for 1.50 hrs; electrical conductivity 38.87 and 26.56 x 10^4 $ohm^{-1}cm^{-1}$ at 20 and 200 C respectively.

DATA TABLE NO. 103 THERMAL CONDUCTIVITY OF [COPPER + CADMIUM] ALLOYS

(Cu + Cd > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
293.2	3.448
473.2	3.519
CURVE 2*	
293.2	2.761
473.2	3.117

* No graphical presentation

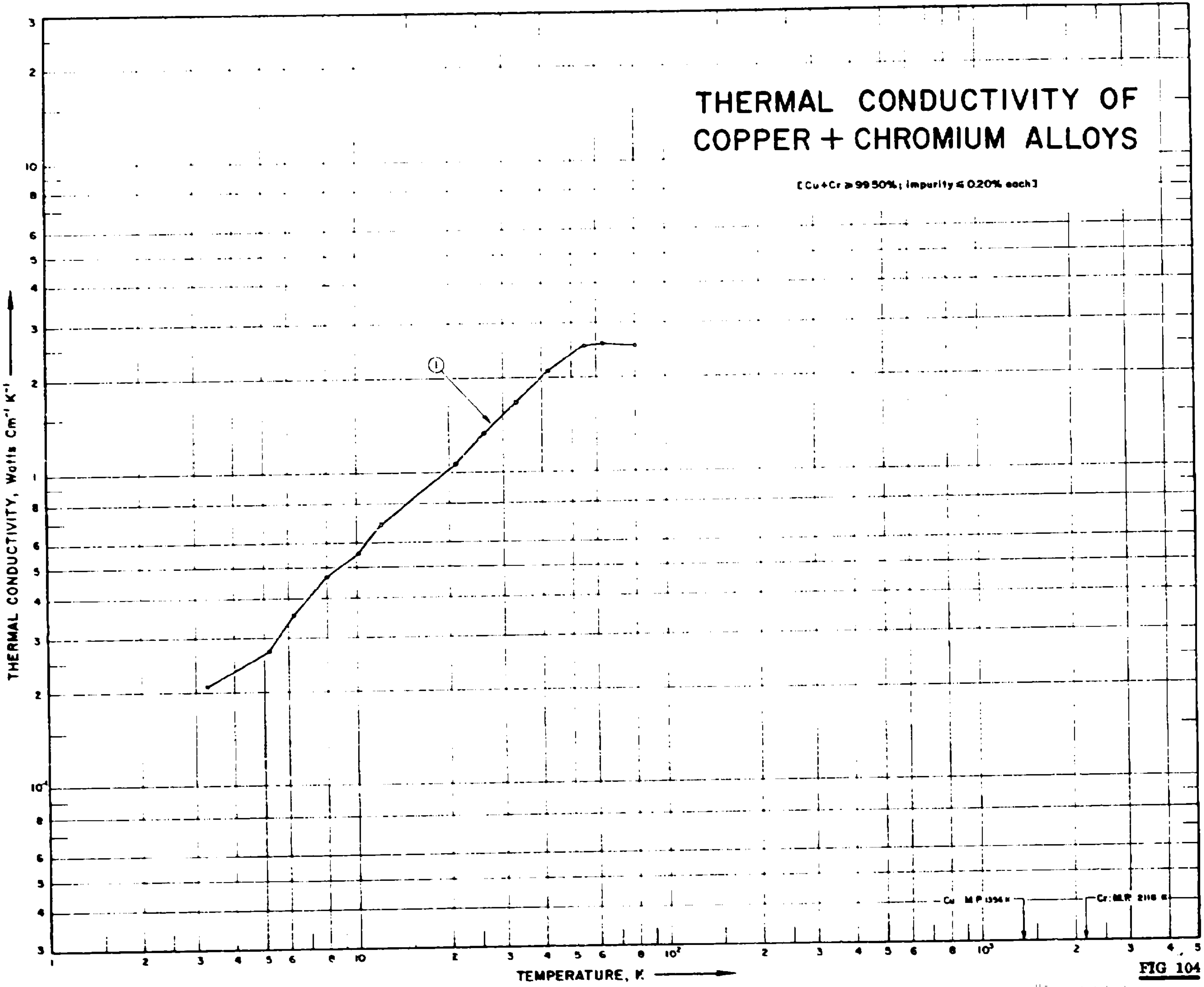

THERMAL CONDUCTIVITY OF
COPPER + CHROMIUM ALLOYS
[Cu+Cr ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
1
Cu M.P. 1356 K
Cr: M.P. 2118 K

FIG 104

SPECIFICATION TABLE NO. 104 THERMAL CONDUCTIVITY OF [COPPER + CHROMIUM] ALLOYS

(Cu + Cr ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 104]

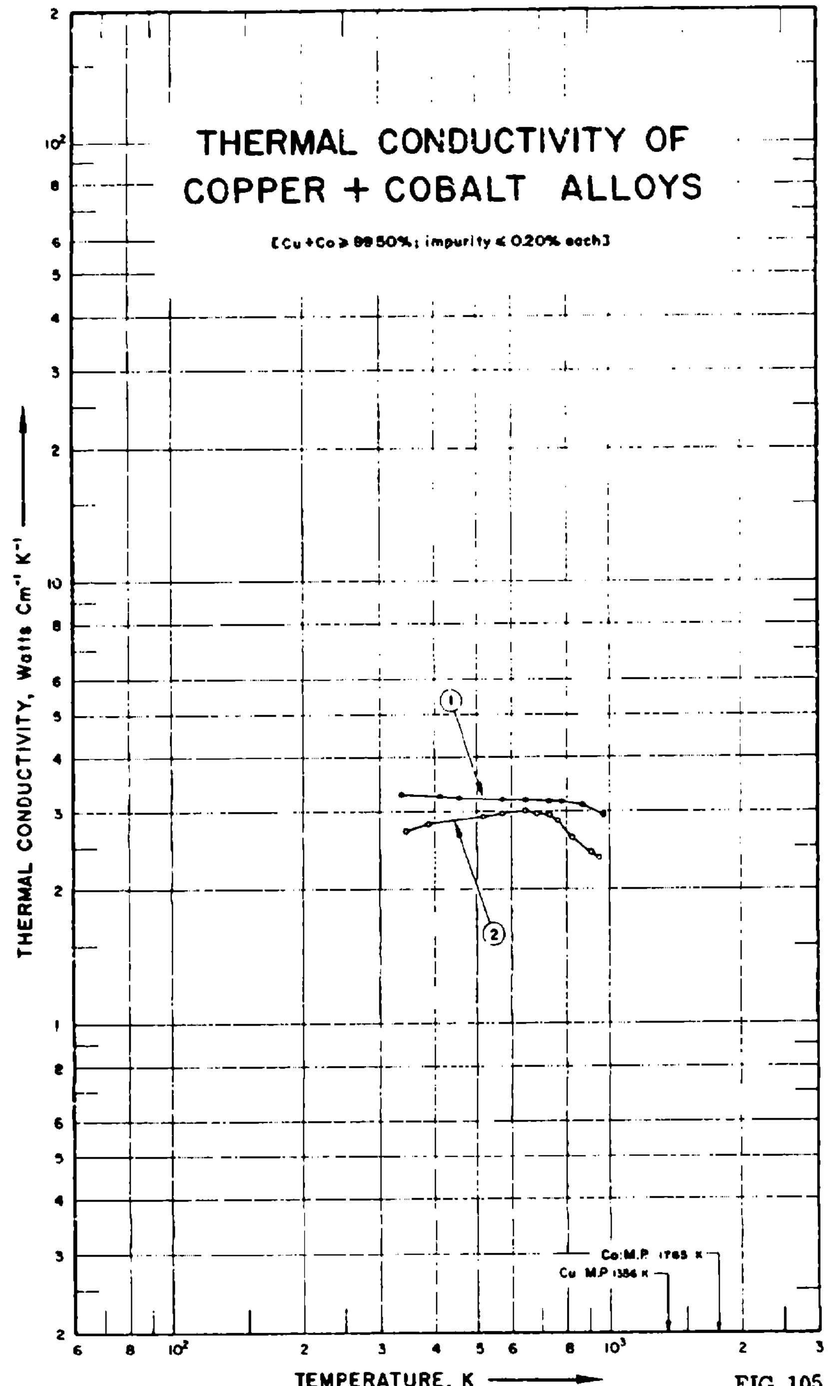
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Cr	Composition (continued), Specifications and Remarks
1	154	L	1956	3.3-80	≤ 5.0	Russian cupralloy type 5	99.2	0.61	0.18 Ag; unannealed.

DATA TABLE NO. 104 THERMAL CONDUCTIVITY OF [COPPER + CHROMIUM] ALLOYS

(Cu + Cr ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
3.28	0.209
5.20	0.272
6.23	0.351
8.00	0.469
10.2	0.556
12.0	0.686
21.0	1.06
26.0	1.33
33.0	1.67
42.0	2.09
55.0	2.51
63.2	2.55
80.0	2.51



THERMAL CONDUCTIVITY OF
COPPER + COBALT ALLOYS
[Cu+Co ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Co M.P. 1765 K
Cu M.P. 1356 K
1
2

FIG 105

SPECIFICATION TABLE NO. 105 THERMAL CONDUCTIVITY OF [COPPER + COBALT] ALLOYS

(Cu + Co > 99.50%; Impurity < 0.20% each)

[For Data Reported in Figure and Table No. 105]

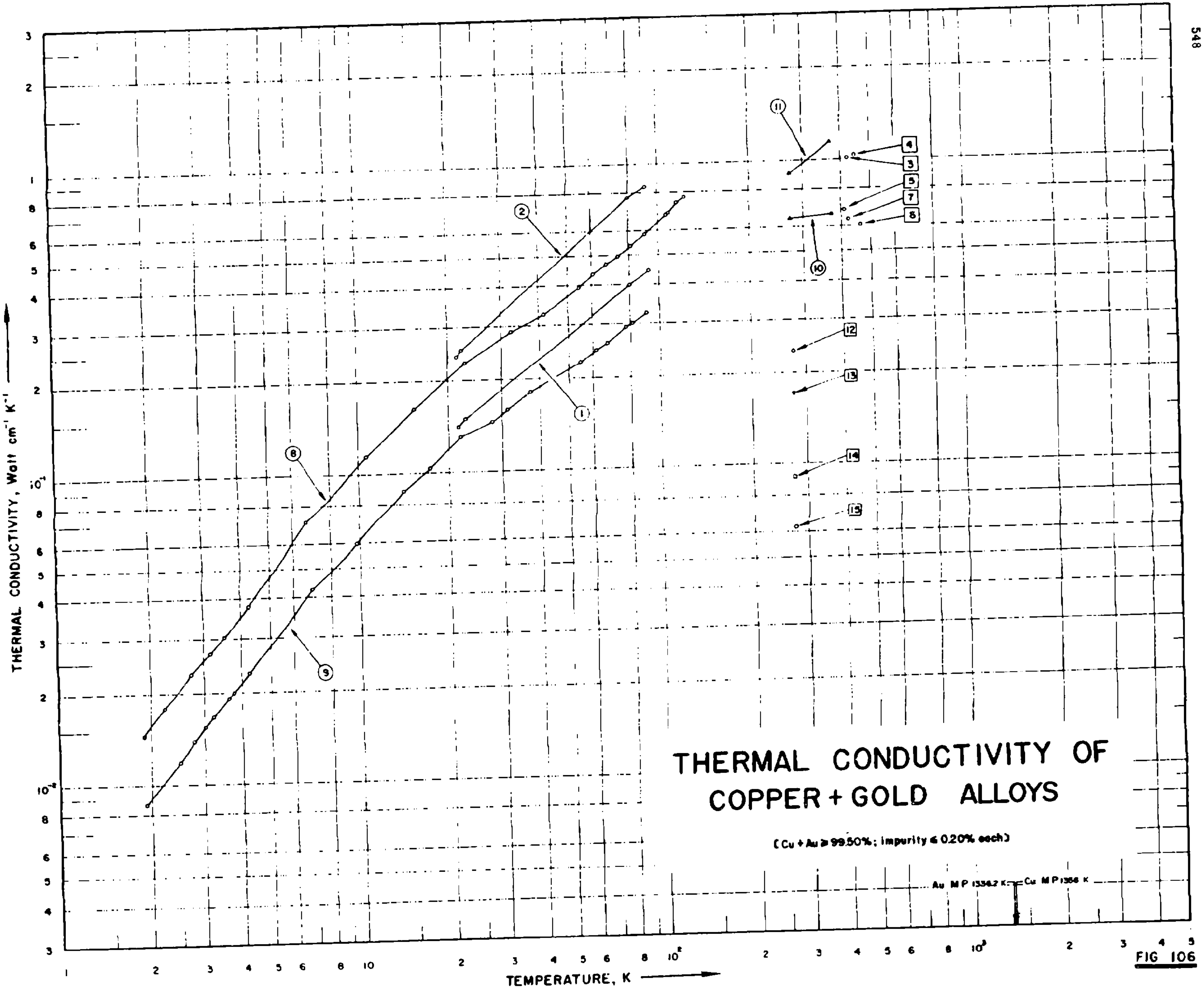
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Co	Composition (continued), Specifications and Remarks
1	377		1957	337-973			>99.23	0.60	0.10 Zr, 0.03 F; electrical conductivity reported at 63.3, 138, 181.8, 302.0, 376.3, 457.5, 508.3, 600 and 700 C respectively as 39.8, 32.0, 28.90, 22.61, 19.8, 17.37, 16.14, 14.20 and 12.05 x 10^4 ohm^{-1} cm^{-1}.
2	541	E	1959	345-948			99.25	0.65	0.1 Be

DATA TABLE NO. 105 THERMAL CONDUCTIVITY OF [COPPER + COBALT] ALLOYS

(Cu + Co > 99.50%; Impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
336.5	3.31
411.2	3.28
455.0	3.25
575.2	3.22
649.5	3.22
730.7	3.19
781.5	3.18
873.2	3.12
973.2	2.95
CURVE 2	
345.0	2.720
388.2	2.820
518.7	2.929
573.2	2.983
648.2	3.025
686.2	2.979
733.2	2.954
766.2	2.870
829.2	2.636
913.2	2.452
948.2	2.377



THERMAL CONDUCTIVITY OF COPPER + GOLD ALLOYS

(Cu + Au ≥ 99.50%; impurity ≤ 0.20% each)

FIG 106

SPECIFICATION TABLE NO. 106 THERMAL CONDUCTIVITY OF (COPPER + GOLD) ALLOYS

(Cu + Au · 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 106]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Au	Composition (continued), Specifications and Remarks
1	58	L	1934	22-93			75.2	24.8	Calculated composition; polycrystalline; unannealed; ~~[illegible]~~ electrical resistivity 6.54, 5.09, and 4.71 μohm cm at ~~[illegible]~~ 0, -190, and -251 C, respectively.
2	58	L	1934	21-91			87.4	12.6	Similar to above specimen except ~~[illegible]~~ electrical resistivity 3.88, 2.487, and 2.172 μohm cm at ~~[illegible]~~ 0, -190, and -251 C, respectively.
3	232	L	1957	422.7			56.33	43.67	Calculated composition; specimen 1.43 cm long with cross section 0.63 cm²; density 14.3 g cm⁻³; cast.
4	232	L	1957	448.2			56.33	43.67	The above specimen; annealed for 10 hrs.
5	232	L	1957	411.2			56.33	43.67	Similar to above specimen; annealed for 20 hrs.
6	232	L	1957	467.2			56.33	43.67	Similar to above specimen; annealed for 30 hrs.
7	232	L	1957	422.2			56.33	43.67	Similar to above specimen; annealed for 40 hrs.
8	233	L	1957	1.9-124			79.9 ~~[illegible]~~	~~[illegible]~~ 20.1	Specimen 8 cm long and 0.5 cm in dia; annealed at 750 C for 1 hr; ρ_0 = 3.53 μohm cm.
9	233	L	1957	1.9-91			62.0 ~~[illegible]~~	~~[illegible]~~ 38.0	Similar to above specimen except ρ_0 = 7.04 μohm cm.
10	246	T	1919	273, 373			55.24	44.76	Calculated composition; specimen rolled and drawn to wire 1 mm dia; heated to near melting point for 0.5 hr; electrical conductivity 5.7 x 10⁴ and 5.5 x 10⁴ ohm⁻¹cm⁻¹ at 0 and 100 C, respectively.
11	246	T	1919	273, 373			73.52	26.48	Similar to above specimen; electrical conductivity 10.7 x 10⁴ and 9.1 x 10⁴ ohm⁻¹cm⁻¹ at 0 and 100 C, respectively.
12	430	T	1924	273.2			94.6	5.4	Calculated composition; specimen rolled and drawn to a wire of 3 cm in length and 1 mm² cross-section, then heated to the melting point; electrical resistivity 8.2 μohm cm at 0 C.
13	430	T	1924	273.2			87.6	12.4	Similar to above specimen except electrical resistivity 4.7 μohm cm at 0 C.
14	430	T	1924	273.2			72.7	27.3	Similar to above specimen except electrical resistivity 7.3 μohm cm at 0 C.
15	430	T	1924	273.2			55.0	45.0	Similar to above specimen except electrical resistivity 10.4 μohm cm at 0 C.

DATA TABLE NO. 106 THERMAL CONDUCTIVITY OF [COPPER + GOLD] ALLOYS

[Cu + Au ≥ 99.50%, impurity ≤ 0.20% each]

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
21.50	0.141
22.70	0.151
80.26	0.400
92.70	0.446
CURVE 2	
21.30	0.239
22.10	0.253
80.00	0.776
91.00	0.841
CURVE 3	
422.70	1.021
CURVE 4	
448.20	1.046
CURVE 5	
411.20	0.686
CURVE 6	
467.20	0.607
CURVE 7	
422.20	0.632
CURVE 8	
1.90	0.0145
2.23	0.0179
2.73	0.0230
3.17	0.0267
3.51	0.0364
4.26	0.0377
6.68	0.0705
10.69	0.1147
CURVE 8 (cont.)	
15.46	0.1627
22.75	0.229
32.34	0.289
41.87	0.325
54.77	0.395
60.94	0.438
67.16	0.471
74.41	0.497
81.10	0.539
90.50	0.587
106.80	0.676
107.90	0.687
116.00	0.740
124.00	0.771
CURVE 9	
1.92	0.00863
2.48	0.0119
2.77	0.0138
3.94	0.0153
3.23	0.0167
3.614	0.0191
3.75	0.0200
4.25	0.0231
6.93	0.0427
9.78	0.0594
14.08	0.0886
17.25	0.1036
21.91	0.1308
27.82	0.146
31.29	0.1604
37.32	0.182
54.75	0.225
61.45	0.247
66.94	0.260
78.70	0.294
81.60	0.302
90.70	0.325
CURVE 10	
273.20	0.64
373.20	0.66
CURVE 11	
273.20	0.91
373.20	1.14
CURVE 12	
273.2	2.37
CURVE 13	
273.2	1.71
CURVE 14	
273.2	0.91
CURVE 15	
273.2	0.62

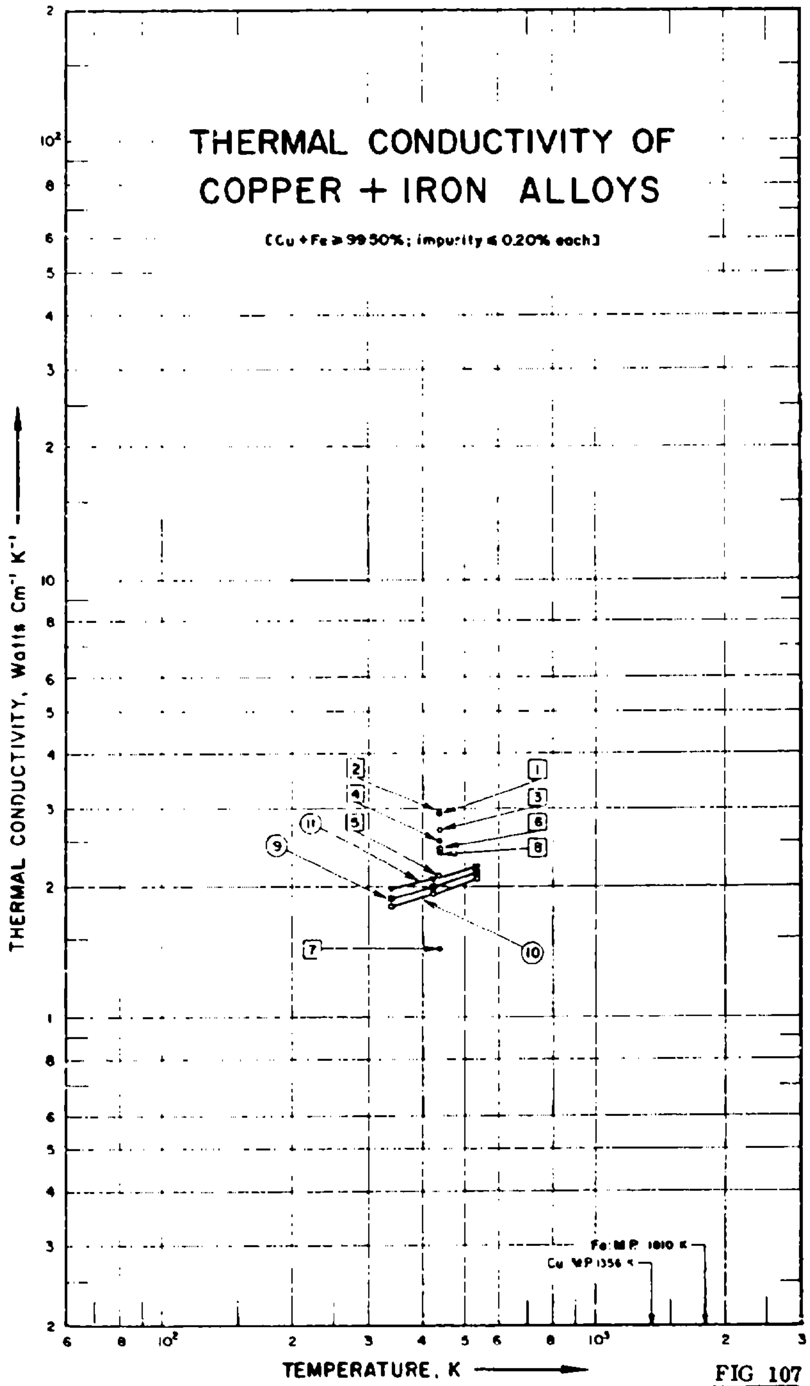

THERMAL CONDUCTIVITY OF
COPPER + IRON ALLOYS
[Cu + Fe ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Fe: M.P. 1810 K
Cu M.P. 1356 K
1
2
3
4
5
6
7
8
9
10
11

FIG 107

SPECIFICATION TABLE NO. 107 THERMAL CONDUCTIVITY OF [COPPER + IRON] ALLOYS

(Cu + Fe > 99.50%, impurity < 0.20% each)

[For Data Reported in Figure and Table No. 107]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Fe	Composition (continued), Specifications and Remarks
1	67	L	1932	438.2			>99.80	0.20	High grade electrolytic Cu with traces of impurities; specimen 6.5 in. long and 0.5 in. in diameter; heated at 1000 C for 1 hr. then quenched.
2	67	L	1932	438.2			>99.80	0.20	Similar to the above specimen; heated at 650 C for 1 hr. then quenched.
3	67	L	1932	438.2			>99.71	0.29	Similar to the above specimen; heated at 1000 C for 1 hr. then quenched.
4	67	L	1932	438.2			>99.71	0.29	Similar to the above specimen; heated at 650 C for 1 hr. then quenched.
5	67	L	1932	438.2			>99.50	0.50	Similar to the above specimen; heated at 1000 C for 1 hr. then quenched.
6	67	L	1932	438.2			>99.50	0.50	Similar to the above specimen; heated at 650 C for 1 hr. then quenched.
7	67	L	1932	438.2			>98.93	1.07	Similar to the above specimen; heated at 1000 C for 1 hr. then quenched.
8	67	L	1932	438.2			>98.93	1.07	Similar to the above specimen; heated at 650 C for 1 hr. then quenched.
9	52	L	1952	339-533	±5.0	F	98.736	1.25	0.014 P; specimen 0.5 in. in diameter and 6 in. long.
10	52	L	1952	339-533	±5.0	G	95.822	4.16	0.018 P; specimen 0.5 in. in diameter and 6 in. long.
11	52	L	1952	339-533		E	99.568	0.42	0.012 P; similar to above specimen.

DATA TABLE NO. 107 THERMAL CONDUCTIVITY OF [COPPER + IRON] ALLOYS

(Cu + Fe ≥ 99.50%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
438.2	2.937
CURVE 2	
438.2	2.983
CURVE 3	
438.2	2.678
CURVE 4	
438.2	2.523
CURVE 5	
438.2	2.113
CURVE 6	
438.2	2.427
CURVE 7	
438.2	1.431
CURVE 8	
438.2	2.385
CURVE 9	
338.7	1.886
422.1	2.008
533.2	2.163
CURVE 10	
338.7	1.817
422.1	1.938
533.2	2.094
CURVE 11	
338.7	1.990
422.1	2.077
533.2	2.215

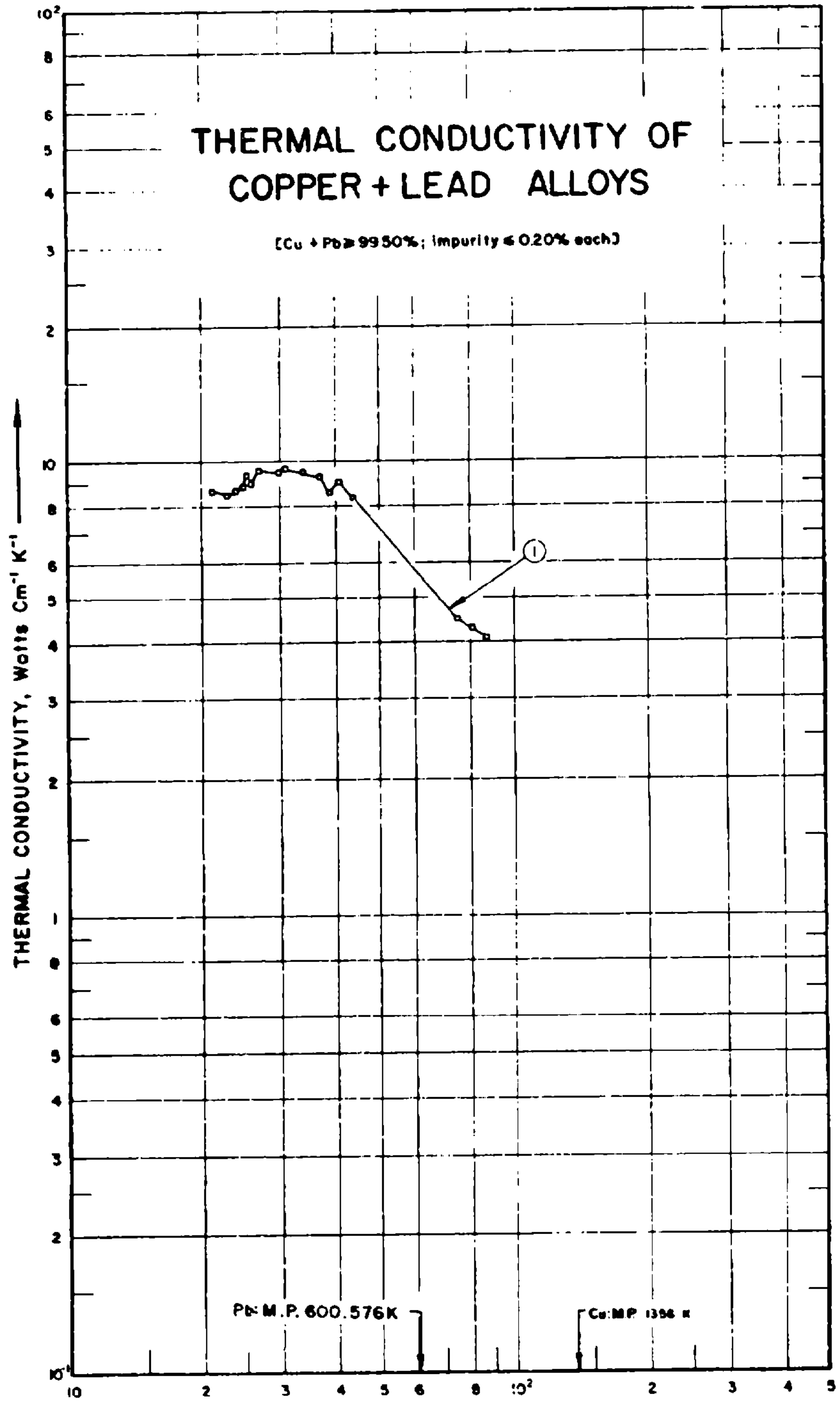

THERMAL CONDUCTIVITY OF
COPPER + LEAD ALLOYS
[Cu + Pb ≥ 99.50%; impurity ≤ 0.20% each]
1
Pb: M.P. 600.576K
Cu: M.P. 1356 K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 108

SPECIFICATION TABLE NO. 108 THERMAL CONDUCTIVITY OF [COPPER + LEAD] ALLOYS

(Cu + Pb ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 108]

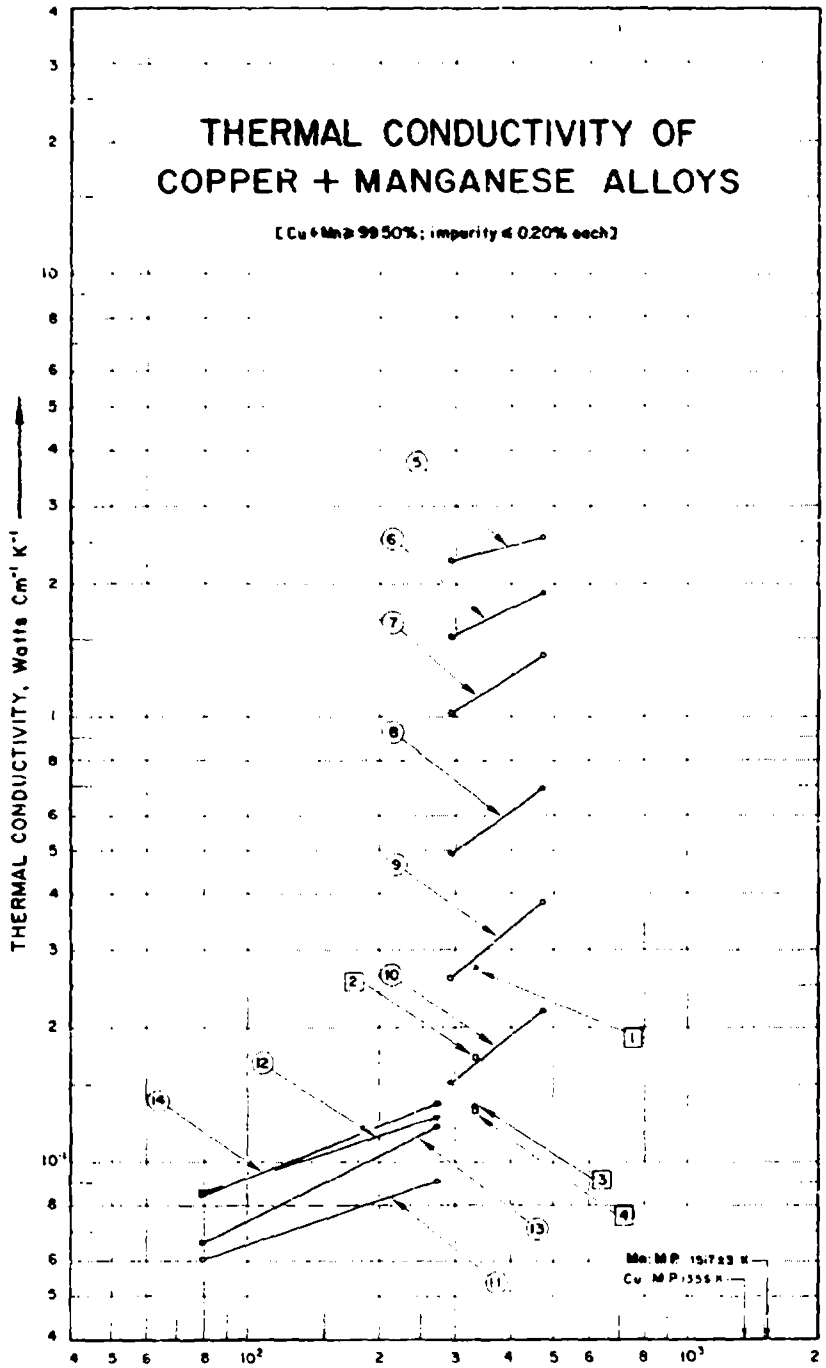
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Pb	Composition (continued), Specifications and Remarks
1	582	L	1955	21-87		Lead Cu-126	98.94	1.04	Specimen 0.25 in. in dia; supplied by Kenosha plant of the American Brass Co.; commercial hard-drawn temper rod; grain size 0.004 cm in transverse section and about 0.008 cm long by 0.004 cm wide in the longitudinal section.

DATA TABLE NO. 108 THERMAL CONDUCTIVITY OF [COPPER + LEAD] ALLOYS

(Cu + Pb ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
21.3	8.70
23.0	9.50
24.0	8.70
25.0	8.90
25.5	9.40
26.0	9.00
27.0	9.60
30.0	9.50
31.0	9.70
34.0	9.50
37.0	9.30
39.0	8.60
41.0	9.90
44.0	8.40
75.0	4.50
81.0	4.30
87.0	4.10



THERMAL CONDUCTIVITY OF
COPPER + MANGANESE ALLOYS
[Cu+Mn ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Mn: M.P. 1517±3 K
Cu: M.P. 1356 K

FIG 109

SPECIFICATION TABLE NO. 109 THERMAL CONDUCTIVITY OF [COPPER + MANGANESE] ALLOYS

(Cu + Mn > 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 109]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Mn	Composition (continued), Specifications and Remarks
1	230	L	1925	332.2			90.0	10.0	Approx. composition; specimen ~5 cm long with cross section 0.3 cm^2; made from Cu (< 0.03 of total impurity) supplied by Baker, fused with Mn supplied by Eimer and Amend; electrical conductivity 2.76 x 10^4 ohm^{-1} cm^{-1} at 23 C.
2	230	L	1925	332.2			80	20	Similar to the above specimen except electrical conductivity 1.59 x 10^4 ohm^{-1} cm^{-1} at 23 C.
3	230	L	1925	332.2			70	30	Similar to the above specimen except electrical conductivity 1.11 x 10^4 ohm^{-1} cm^{-1} at 23 C.
4	230	L	1925	332.2			60	40	Similar to the above specimen except electrical conductivity 0.916 x 10^4 ohm^{-1} cm^{-1} at 23 C.
5	135	L	1935	293, 473		Bar 116	99.55	0.43	0.01 Fe, 0.01 Mg; specimen 0.75 in. in diameter and 8 in. long; supplied by American Brass Co.; annealed at 700 C for 2 hrs.; electrical conductivity 29.56 and 22.00 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
6	135	L	1935	293, 473		Bar 117	99.05	1.65	0.01 Fe, 0.01 Mg; similar to the above specimen except electrical conductivity 19.07 and 15.84 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
7	135	L	1935	293, 473		Bar 118	98.27	1.77	0.03 Fe, 0.01 Mg; similar to the above specimen except electrical conductivity 12.54 and 11.22 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
8	135	L	1935	293, 473		Bar 119	95.34	4.55	0.06 Fe, 0.02 Mg; similar to the above specimen except electrical conductivity 5.567 and 5.446 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
9	135	L	1935	293, 473		Bar 120	90.25	9.53	0.18 Fe, 0.02 Mg, 0.021 C; similar to the above specimen except electrical conductivity 2.814 and 2.829 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
10	135	L	1935	293, 473		Bar 121	80.03	19.82	0.09 Fe, 0.02 Mg, 0.035 C; similar to the above specimen except electrical conductivity 1.453 and 1.474 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
11	34		1927	80, 273		1	70	30	Approx. composition; coarse grain; electrical conductivity 0.784 and 0.743 x 10^4 ohm^{-1} cm^{-1} at 80 and 273 K respectively.

SPECIFICATION TABLE NO. 109 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Mn	Composition (continued), Specifications and Remarks
12	34		1927	80, 273		2	70	30	Approx. composition; medium grain; electrical conductivity 1.09 and 1.054 x 10^4 ohm^{-1} cm^{-1} at 80 and 273 K respectively.
13	34		1927	80, 273		3	70	30	Approx. composition, medium grain, electrical conductivity 0.902 and 0.863 x 10^4 ohm^{-1} cm^{-1} at 80 and 273 K respectively.
14	34		1927	80, 273		4	70	30	Approx. composition; fine grain; electrical conductivity 1.034 and 0.951 x 10^4 ohm^{-1} cm^{-1} at 80 and 200 C respectively.

DATA TABLE NO. 109 THERMAL CONDUCTIVITY OF [COPPER + MANGANESE] ALLOYS

(Cu + Mn ≥ 99.50%; Impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1} K^{-1}$]

T	k
CURVE 1	
332.2	0.272
CURVE 2	
332.2	0.172
CURVE 3	
332.2	0.134
CURVE 4	
332.2	0.130
CURVE 5	
293.2	2.259
473.2	2.561
CURVE 6	
293.2	1.502
473.2	1.900
CURVE 7	
293.2	1.021
473.2	1.389
CURVE 8	
293.2	0.490
473.2	0.690

T	k
CURVE 9	
293.2	0.259
473.2	0.381
CURVE 10	
293.2	0.151
473.2	0.218
CURVE 11	
80	0.0605
273	0.0905
CURVE 12	
80	0.0856
273	0.126
CURVE 13	
80	0.066
273	0.120
CURVE 14	
80	0.0849
273	0.136

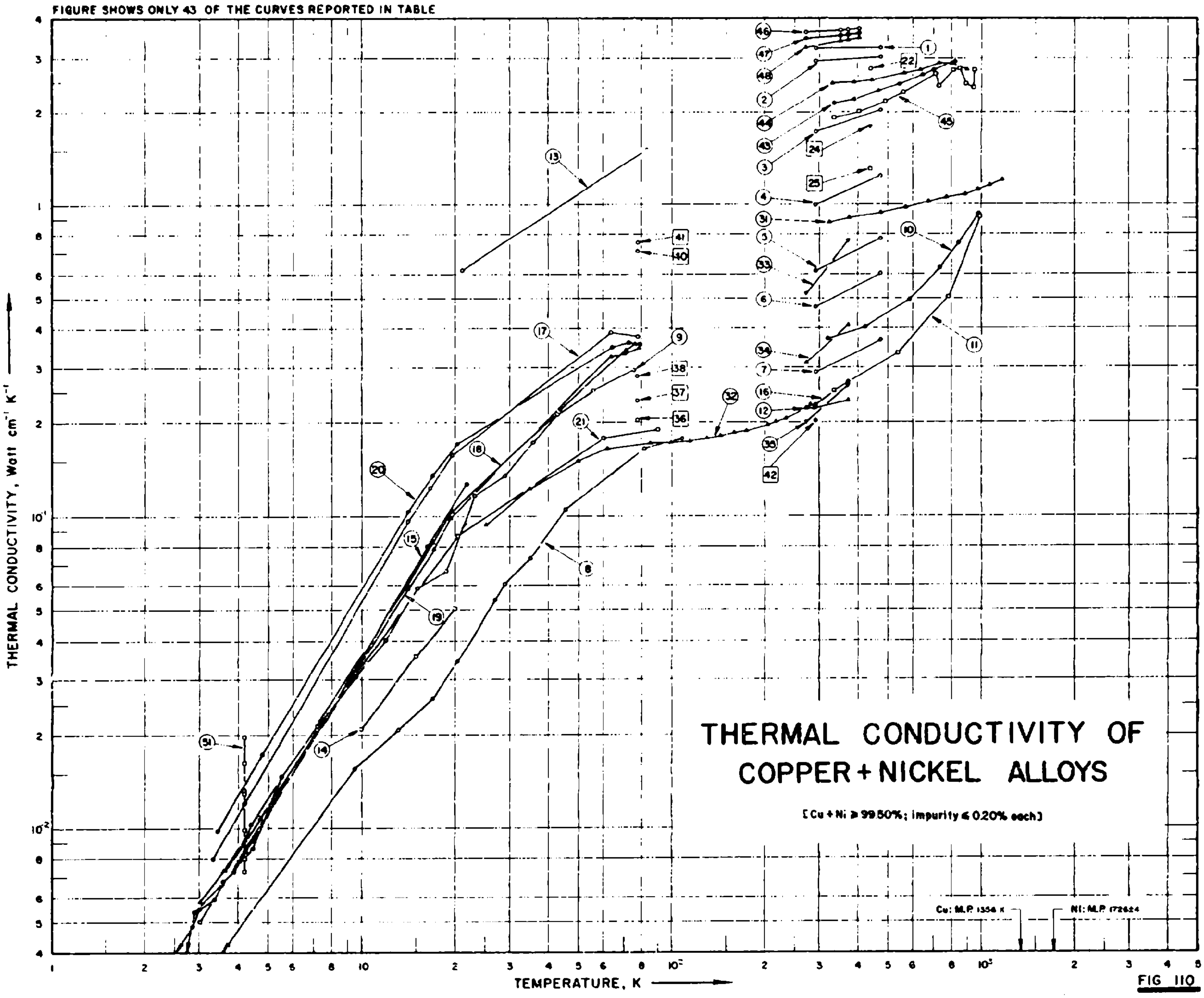


FIGURE SHOWS ONLY 43 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF COPPER + NICKEL ALLOYS
[Cu + Ni ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Cu: M.P. 1356 K
Ni: M.P. 1726 K

FIG 110

SPECIFICATION TABLE NO. 110 THERMAL CONDUCTIVITY OF [COPPER + NICKEL] ALLOYS

(Cu + Ni ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 110]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Ni	Composition (continued), Specifications and Remarks
1	135	L	1935	293, 473		Bar 107	99.73	0.28	0.01 Fe, 0.03 Mg; specimen 0.75 in. in diameter and 8 in. long; supplied by American Brass Co.; annealed at 800 C for 2 hrs.; electrical conductivity 45.70 and 29.11 x 10^4 ohm^{-1} cm^{-1} at 20 C and 200 C respectively.
2	135	L	1935	293, 473		Bar 108	99.47	0.54	0.02 Fe, 0.04 Mg; similar to the above specimen except annealed at 800 C for 3 hrs.; electrical conductivity 39.94 and 26.86 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
3	135	L	1935	293, 473		Bar 109	97.94	1.97	0.02 Fe, 0.04 Mg; similar to the above specimen except annealed at 800 C for 4 hrs.; electrical conductivity 22.71 and 17.58 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
4	135	L	1935	293, 473		Bar 110	94.92	5.09	0.01 Fe, 0.03 Mg, similar to the above specimen except electrical conductivity 12.39 and 10.64 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
5	135	L	1935	293, 473		Bar 111	89.90	10.07	0.02 Fe, 0.03 Mg, 0.024 C, similar to the above specimen except electrical conductivity 7.07 and 6.46 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
6	135	L	1935	293, 473		Bar 125	84.85	15.07	0.05 Fe, 0.01 Mg, 0.03 Mn; similar to the above specimen except electrical conductivity 5.094 and 4.795 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
7	135	L	1935	293, 473		Bar 124	69.51	30.23	0.05 Fe, 0.05 Mg, 0.13 Mn, similar to the above specimen except electrical conductivity 2.754 and 2.730 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
8	154	L	1956	2.3-108		Russian cupro nickel NM-81.7	81.0	19.0	Specimen in strip form cut from a 6 x 5 mm tube; measured in helium, unannealed.
9	154	L	1956	2.5-76		Russian cupro nickel NM-81.6	81.0	19.0	The above specimen annealed at 800 C, measured in helium.
10	124	P	1930	321-984			79.8	20.0	0.2 Mn, trace Mg; specimen ~0.25 cm in diameter and ~35 cm long; chill cast, hot rolled and cold drawn then annealed at 700 C for 12 hrs.; electrical conductivity 3.54, 3.46, 3.33, 3.21, 3.12 and 3.02 x 10^5 ohm^{-1} cm^{-1} at 48, 150, 315, 462, 575 and 711 C respectively.
11	124	P	1930	335-990			59.8	40.0	Similar to the above specimen except electrical conductivity 1.99, 1.99, 1.96 and 1.92 x 10^5 ohm^{-1} cm^{-1} at 62, 266, 510 and 717 C respectively.

SPECIFICATION TABLE NO. 110 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Ni	Composition (continued), Specifications and Remarks
12	8	F	1914	273-373		Eureka	60.0	40.0	Approx. composition; specimen 6 mm in diameter and 9 mm long.
13	57	L	1927	21, 83			99.0	1.0	Specimen 7 cm long and 0.1 to 0.3 cm wide, drawn; electrical resistivity 2.97, 1.60 and 1.295 μ ohm cm at 0, -190 and -252 C respectively.
14	152	L	1949	10-20			70.0	30.0	Approx. composition; specimen 4.1 mm in diameter and 21 mm long, supplied by Yorkshire Copper Works Ltd., cold-worked.
15	75	L	1951	1.9-22			80.0	20.0	Approx. composition; average grain size 0.011 mm.
16	77	E	1900	291, 373			60.0	40.0	Density 8.92 g cm^{-3} at 18 C; electrical conductivity 2.04 and 2.037 x 10^4 ohm^{-1} cm^{-1} at 18 and 100 C respectively.
17	155	L	1951	3.3-78		CN 1	90.0	10.0	Specimen 1/8 in. in diameter; machined from an annealed bar; electrical resistivity 12.5, 12.72 and 14.68 μ ohm cm at 19.7, 78.9 and 296 K respectively.
18	155	L	1951	3.0-76		CN 2	90.0	10.0	Specimen 1/8 in. in diameter; cold-worked by rolling from 0.25 in. thick to 0.14 in. before being machined to size; electrical resistivity 12.65 and 14.69 μ ohm cm at 76.2 and 296 K respectively.
19	155	L	1951	3.6-79		CN 3	90.0	10.0	Specimen 1/8 in. in diameter; severely cold-worked, rolled from 0.5 in.^{2} cross section to 0.22 x 0.24 in. before machining; electrical resistivity 12.63 and 14.65 μ ohm cm at 78.7 and 298 K respectively.
20	155	L	1951	3.4-79		CN 4	90.0	10.0	Single crystal; specimen 1/8 in. in diameter; electrical resistivity 13.0, 13.10 and 15.04 μ ohm cm at 20.5, 79.3 and 298 K respectively.
21	9	L	1951	3.0-91			60.0	40.0	36 gauge wire bound and soldered together.
22	67	L	1932	438.2			≤ 99.22	0.78	High grade electrolytic Cu with traces of impurities; specimen 6.5 in. long and 0.5 in. in diameter; annealed at 900 C.
23	67	L	1932	438.2			≤ 98.43	1.57	Similar to the above specimen.
24	67	L	1932	438.2			≤ 97.24	2.76	Similar to the above specimen.
25	67	L	1932	438.2			≤ 95.1	4.9	Similar to the above specimen.

SPECIFICATION TABLE NO. 110 (continued)

Curve No.	Ref. No.	Method Used*	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Ni	Composition (continued), Specifications and Remarks
26	230	L	1925	330.2			50	50	Approx composition; specimen ~5 cm long with cross section 0.3 cm²; made from Cu (< 0.03 of total impurity) supplied by Baker, fused with Ni (99.75 to 99.85 pure including cobalt) supplied by International Nickel Co. of America; electrical conductivity 1.98 x 10^4 ohm^{-1}cm^{-1} at 25 C.
27	230	L	1925	330.2			60.0	40.0	Approx composition; similar to the above specimen except electrical conductivity 2.04 x 10^4 ohm^{-1}cm^{-1} at 25 C.
28	230	L	1925	330.2			70	30	Similar to the above specimen except electrical conductivity 2.48 x 10^4 ohm^{-1}cm^{-1} at 25 C.
29	230	L	1925	330.2			90	10	Similar to the above specimen except electrical conductivity 3.49 x 10^4 ohm^{-1}cm^{-1} at 25 C.
30	186	P	1928	305.2		Advance	55.0	45.0	Approx composition; impurity < 0.03.
31	131	C	1953	323-1173	± 2.0	Lohm	93.4	6.05	0.01 Mn, 0.01 Si; annealed at 900 C; lead used as comparative material.
32	219	L	1951	26-295	< 2.3	Constantan	55.0	45.0	
33	246	T	1919	273,373			89.94	10.06	Calculated composition; specimen rolled and drawn to 1 mm thick; heated 0.5 hr close to melting point; electrical conductivity 6.2 and 6.1 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
34	246	T	1919	273,373			[illegible]	20.1[illegible]	Similar to the above specimen except electrical conductivity 3.5 and 3.3 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
35	246	T	1919	273,373			[illegible]	19.98	Similar to the above specimen except electrical conductivity 2.0 and 2.0 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
36	433	L	1940	78.2		8	≈70.05	≈29.89	Cu-Ni alloy containing 0.03 Mn, 0.03 Fe, and traces of other impurities, made from electrolytic Ni (containing 0.53 Co, 0.05 Fe, 0.02 Al) and electrolytic Cu (containing 0.015 Sb, 0.01 Fe, 0.007 S and trace of P); specimen 4.0 mm in dia and 6 mm long; electrical resistivity 40.3 μohm cm at -195 C.
37	433	L	1940	78.2		9	≈80.11	≈19.83	The alloy containing 0.04 Mn, 0.02 Fe and traces of other impurities made from the same materials as above; electrical resistivity 27.1 μohm cm at -195 C.

SPECIFICATION TABLE NO. 110 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Ni	Composition (continued), Specifications and Remarks
38	433	L	1940	78.2		10	86.05	13.84	0.11 Fe and trace Mn; made from the same material as above; electrical resistivity 17.6 μ ohm cm at -195 C.
39	433	L	1940	78.2		11	90.39	9.47	0.14 Fe, traces of Mn and other impurities; made from the same materials as above; electrical resistivity 11.9 μohm cm at -195 C.
40	433	L	1940	78.2		12	96.24	3.67	0.09 Fe and traces of other impurities; as above but electrical resistivity 3.43 μ ohm cm at -195 C.
41	433	L	1940	78.2		13	98.94	1.03	0.03 Fe and traces of other impurities; as above but electrical resistivity 1.039 μ ohm cm at -195 C.
42	435	L	1900	291.2			54.0	46.0	Approx. composition; density 8.89 g cm^{-3}; electrical conductivity 1.99 x 10^5 ohm^{-1} cm^{-1} at 18 C.
43	377		1957	336-825			99.05	0.70	0.1 Be, 0.15 Co; electrical conductivity 25.8, 23.1, 20.4, 18.25, 16.5, 15.67 and 14.33 x 10^4 ohm^{-1} cm^{-1} at 63.0, 114.6, 195, 273, 375.8, 433.5 and 551.3 C respectively.
44	378		1957	333-900			98.90	0.90	0.10 Be, 0.10 Zr; electrical resistivity 3.34, 3.85, 4.33, 5.21, 5.78, 6.33, 7.05 and 8.14 μohm cm at 59.4, 115.6, 171.5, 291.6, 365.6, 457, 534.5 and 626.5 C respectively.
45	378		1957	336-947			99.0	0.80	0.20 Ti; electrical resistivity 4.25, 4.88, 5.56, 6.01, 6.40, 6.57, 7.18, 7.28, 7.66, 8.93 and 9.78 μohm cm at 62.8, 130.9, 217.5, 290.6, 462.5, 440.3, 580.3, 538.3, 674.3, 618.0 and 673.6 C respectively.
46	271	L	1938	273-403	0.11	3	99.717	0.204	0.079 O; specimen 50.6 cm long.
47	271	L	1938	273-403	0.11	4	99.618	0.303	0.079 O; specimen 50.6 cm long.
48	271	L	1938	273-403	0.11	5	99.413	0.508	0.079 O; specimen 50.6 cm long.
49	271	L	1938	273-403	0.11	9	99.961	0.303	0.0042 Fe, 0.0014 Pb, trace Sn and Zn; specimen 50.6 cm long.
50	271	L	1938	273-403	0.11	10	99.47	0.508	0.022 O; specimen 50.6 cm long.
51	612	E	1962	4.2			60.0	40.0	Approx. composition; specimen about 1 to 3 mm in diameter and ~ 100 mm long; measured in different strain conditions.

DATA TABLE NO. 110 THERMAL CONDUCTIVITY OF [COPPER + NICKEL] ALLOYS

(Cu + Ni 99 - 9%, impurity ~ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

	T	k
CURVE 1	293.00	3.217
	473.00	3.243
CURVE 2	293.00	2.920
	473.00	5.004
CURVE 3	293.00	1.715
	473.00	2.013
CURVE 4	293.00	0.936
	473.00	1.243
CURVE 5	293.00	0.615
	473.00	0.774
CURVE 6	293.00	0.469
	473.00	0.602
CURVE 7	293.00	0.289
	473.00	0.368
CURVE 8	2.35	0.00189*
	3.12	0.00335*
	9.50	0.0156
	13.20	0.0207
	17.00	0.0261
	20.50	0.0343
CURVE 8 (cont.)	27.00	0.0536
	29.00	0.0603
	35.00	0.0736
	45.50	0.105
	82.00	0.163
	108.00	0.177
CURVE 9	2.58	0.00314
	2.90	0.00536
	4.48	0.00858
	5.52	0.0146
	7.20	0.0213
	9.60	0.0305
	12.00	0.0402
	15.10	0.0586
	18.80	0.0669
	23.20	0.116
	29.00	0.134
	35.80	0.172
	43.10	0.213
	56.00	0.251
	75.50	0.293
CURVE 10	321.20	0.372
	423.20	0.402
	588.20	0.494
	735.20	0.628
	848.20	0.745
	984.20	0.933
CURVE 11	335.20	0.251
	539.20	0.335
	783.20	0.506
	990.20	0.912
CURVE 12	273.00	0.222
	290.00	0.222
	373.00	0.234
CURVE 13	21.20	0.620
	83.20	1.500
CURVE 14	10.00	0.0209
	15.00	0.0356
	20.00	0.0502
CURVE 15	1.89	0.00281
	2.40	0.00372*
	2.86	0.00485
	3.02	0.00549
	3.38	0.00590
	3.60	0.00677
	3.88	0.00725
	4.05	0.00784
	4.23	0.00841
	4.45	0.00908
	16.30	0.07990
	21.90	0.1270
CURVE 16	291.20	0.226
	373.20	0.268
CURVE 17	3.33	0.00796
	4.21	0.0120
	14.10	0.0964
	16.70	0.123
CURVE 17 (cont.)	19.70	0.157
	64.00	0.388
	78.00	0.378
CURVE 18	3.03	0.00580
	3.61	0.00734
	4.21	0.00917
	4.40	0.0103
	11.07	0.0601
	17.09	0.0825
	19.70	0.104
	71.30	0.343
	76.20	0.358
CURVE 19	3.63	0.00735
	4.20	0.00892
	4.72	0.0108
	14.10	0.0587
	17.20	0.0786
	19.40	0.0986
	64.00	0.326
	70.60	0.333
	78.70	0.348
CURVE 20	3.45	0.00980
	4.89	0.0173
	14.20	0.104
	17.00	0.135
	20.50	0.170
	64.50	0.350
	73.00	0.361
	79.30	0.357
CURVE 21	3.03	0.0050
	5.12	0.0118
	9.53	0.0313
	20.50	0.0860
	60.30	0.177
	90.60	0.189
CURVE 22	438.2	2.741
CURVE 23	438.2	2.351
CURVE 24	438.2	1.778
CURVE 25	438.2	1.297
CURVE 26	330.2	0.226
CURVE 27	330.2	0.226
CURVE 28	330.2	0.241
CURVE 29	330.2	0.369
CURVE 30*	305.2	0.228
CURVE 31	323.20	0.889
	373.20	0.907
	473.20	0.944
	573.20	0.980
	673.20	1.016
	773.20	1.053
	873.20	1.089
	973.20	1.126
	1073.20	1.162
	1173.20	1.199
CURVE 32	25.34	0.0937
	34.77	0.122
	49.96	0.149
	62.30	0.164
	85.97	0.169
	99.56	0.171
	109.60	0.171
	114.03	0.174
	130.22	0.177
	144.93	0.180
	159.71	0.185
	160.02	0.185
	174.68	0.187
	174.86	0.188
	204.37	0.195
	218.52	0.200
	234.15	0.205
	263.16	0.218
	284.32	0.226
	295.00	0.230
CURVE 33	273.2	0.52
	373.2	0.76
CURVE 34	273.2	0.31
	373.2	0.41
CURVE 35	273.2	0.20
	373.2	0.26
CURVE 36	78.2	0.201
CURVE 37	78.2	0.234
CURVE 38	78.2	0.280
CURVE 39*	78.2	0.351
CURVE 40	78.2	0.703
CURVE 41	78.2	1.75
CURVE 42	291.2	0.203
CURVE 43	336.2	2.13
	387.8	2.19
	468.2	2.33
	546.2	2.45
	649.0	2.62
	706.7	2.73
	824.5	2.90

* Not shown on plot

DATA TABLE NO. 110 (continued)

T	κ	T	κ
CURVE 44		CURVE 49*	
332.6	2.46	273.2	3.456
388.8	2.48	353.2	3.520
444.7	2.52	373.2	3.535
564.8	2.66	403.2	3.560
638.8	2.73		
730.2	2.86	CURVE 50*	
807.7	2.86		
899.7	2.74	273.2	3.318
		353.2	3.389
CURVE 45		373.2	3.406
		403.2	3.431
336.0	1.91		
404.1	1.99	CURVE 51	
490.7	2.16	(T = 4.2° K)	
563.8	2.31	Strain	K(Watt cm⁻¹ K⁻¹)
735.7	2.42		
713.5	2.66	0	0.0197
853.5	2.75	0.009	0.0163
811.5	2.73	0.019	0.0131
947.5	2.73	0.024	0.0130
891.2	2.45	0.053	0.0099
946.8	2.38	0.125	0.008
		0.193	0.0073
CURVE 46			
273.2	3.610		
353.2	3.657		
373.2	3.670		
403.2	3.686		
CURVE 47			
273.2	3.464		
353.2	3.527		
373.2	3.544		
403.2	3.565		
CURVE 48			
273.2	3.251		
353.2	3.397		
373.2	3.435		
403.2	3.490		

* Not shown on plot

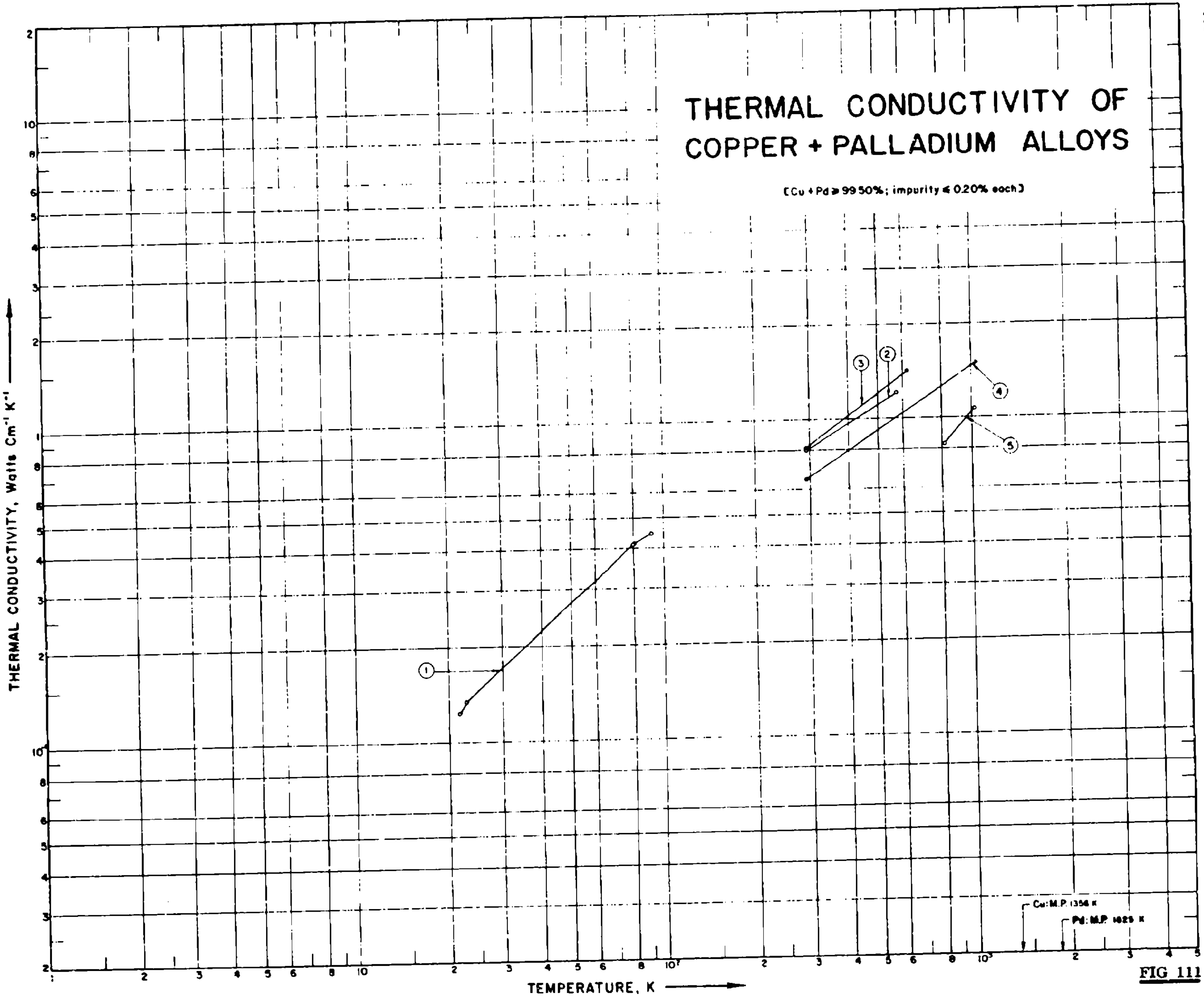

THERMAL CONDUCTIVITY OF
COPPER + PALLADIUM ALLOYS
[Cu + Pd ≥ 99.50%; impurity ≤ 0.20% each]
1
2
3
4
5
Cu: M.P. 1356 K
Pd: M.P. 1825 K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 111

SPECIFICATION TABLE NO. 111 THERMAL CONDUCTIVITY OF [COPPER + PALLADIUM] ALLOYS

[Cu + Pd ≥ 99.50%; impurity ≤ 0.20% each]

[For Data Reported in Figure and Table No. 111]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Pd	Composition (continued), Specifications and Remarks
1	58	L	1934	22-91			89.7	10.3	Calculated composition, polycrystal; unannealed; ~~[illegible]~~ electrical resistivity 6.82, 5.508, and 5.184 μ ohm cm at 0, -190, ~~[illegible]~~ and -251 C, respectively.
2	391	L	1958	293, 573	3.0		75.82	24.18	Calculated composition; annealed at 600 to 700 C for 2 hrs.; with ordered atomic arrangement.
3	391	L	1958	293, 623	3.0		64.18	35.82	Similar to the above specimen.
4	391	L	1958	293, 1048	3.0		75.82	24.18	Similar to the above specimen.
5	391	L	1958	818, 1028	3.0		64.18	35.82	Similar to the above specimen.

DATA TABLE NO. 111 THERMAL CONDUCTIVITY OF [COPPER + PALLADIUM] ALLOYS

(Cu + Pd ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
21.6	0.124
22.7	0.135
79.9	0.411
80.3	0.415
91.1	0.448
CURVE 2	
293.2	0.80
573.2	1.22
CURVE 3	
293.2	0.815
623.2	1.41
CURVE 4	
293.2	0.65
1048.2	1.50
CURVE 5	
818.2	0.83
1028.2	1.07

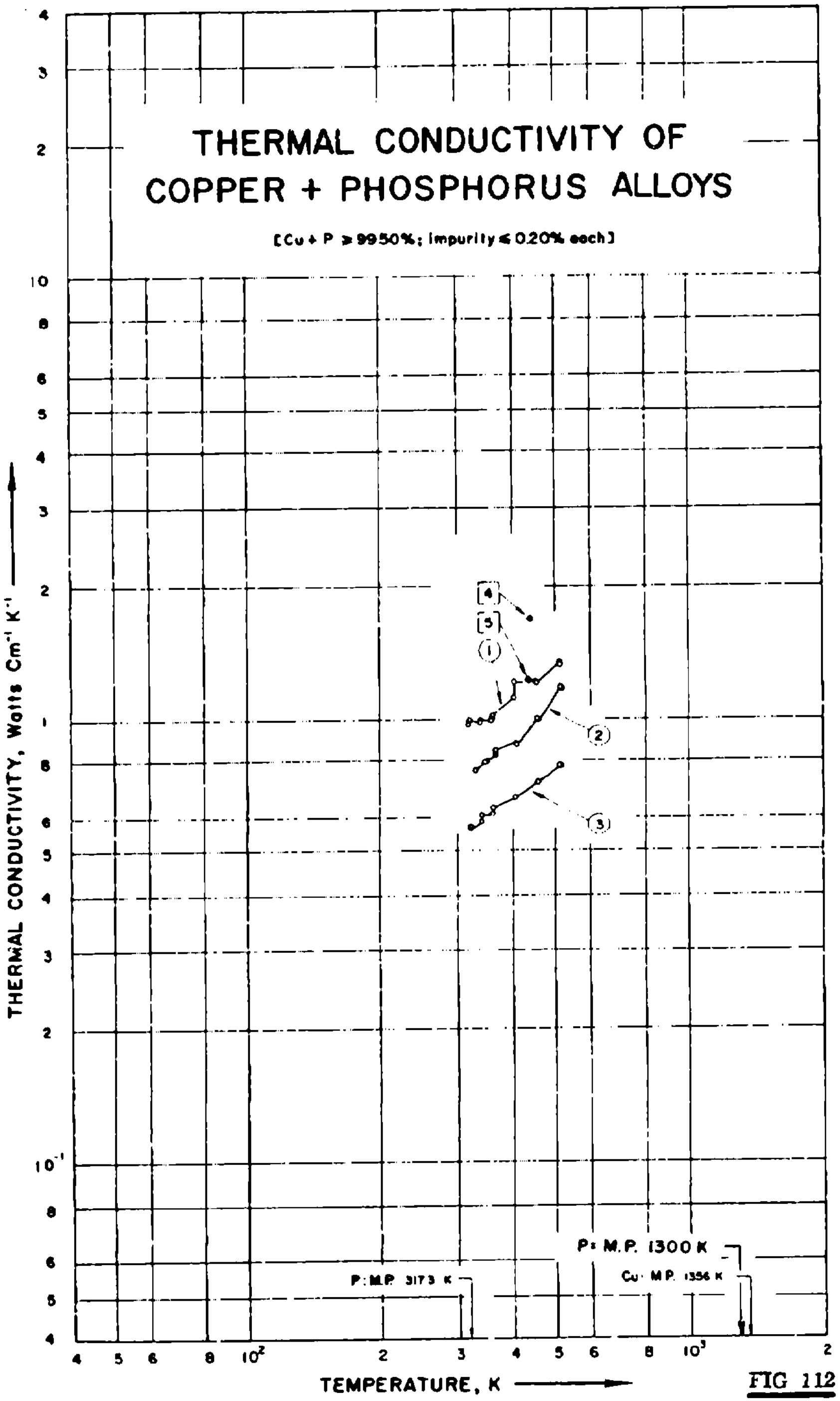

THERMAL CONDUCTIVITY OF
COPPER + PHOSPHORUS ALLOYS
[Cu + P ≥ 99.50%; Impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
P: M.P. 317.3 K
P: M.P. 1300 K
Cu: M.P. 1356 K
1
2
3
4
5

FIG 112

SPECIFICATION TABLE NO. 112 THERMAL CONDUCTIVITY OF [COPPER + PHOSPHORUS] ALLOYS

(Cu + P > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 112]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	P	Composition (continued), Specifications and Remarks
1	134	L	1930	318-512	<2.0	83	99.53	0.460	0.05 Fe; specimen 7/8 in. in diameter; cast, cold-rolled and annealed at 650 C for 1 hr. before machining; electrical conductivity 11.842 x 10^4 ohm^{-1} cm^{-1} at 20 C.
2	134	L	1930	329-516	<2.0	94	99.31	0.677	0.02 Fe; similar to the above specimen except electrical conductivity 8.614 x 10^4 ohm^{-1} cm^{-1} at 20 C.
3	134	L	1930	322-516	<2.0	84	99.12	0.930	0.06 Fe; similar to the above specimen except electrical conductivity 6.5488 x 10^4 ohm^{-1} cm^{-1} at 20 C.
4	67	L	1932	438.2			≈99.771	0.229	High grade electrolytic Cu with traces of impurities; specimen 6.5 in. long and 0.5 in. in diameter; cast and machined; thermal conductivity data obtained from the mean value of 16 readings.
5	67	L	1932	438.2			≈99.594	0.406	Similar to the above specimen.

DATA TABLE NO. 112 THERMAL CONDUCTIVITY OF [COPPER + PHOSPHORUS] ALLOYS

(Cu + P > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
318.2	0.971
320.2	0.996
337.2	0.983
338.2	0.987
339.2	1.004
357.2	0.992
358.2	1.004
360.2	1.017
401.2	1.130
404.2	1.121
452.2	1.218
454.2	1.205
511.2	1.326
512.2	1.305
CURVE 2	
329.2	0.753
329.2	0.757
346.2	0.791
346.2	0.795
347.2	0.799
366.2	0.828
366.2	0.833
366.2	0.841
408.2	0.874
409.2	0.870
454.2	1.004
455.2	1.000
515.2	1.180
516.2	1.176
CURVE 3	
322.2	0.569
322.2	0.561
340.2	0.586
340.2	0.603
361.2	0.611
361.2	0.636
401.2	0.669
CURVE 3 (cont.)	
402.2	0.669
454.2	0.720
455.2	0.720
515.2	0.782
516.2	0.782
CURVE 4	
438	1.665
CURVE 5	
438	1.222

SPECIFICATION TABLE NO. 113 THERMAL CONDUCTIVITY OF [COPPER + PLATINUM] ALLOYS

(Cu + Pt > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Pt	Composition (continued), Specifications and Remarks
1	232	L	1957	465.2			56.57	43.43	Calculated composition; cast.
2	232	L	1957	483.2			56.57	43.43	Calculated composition; after 10 hrs annealing.
3	232	L	1957	481.7			56.57	43.43	Calculated composition; after 20 hrs annealing.
4	232	L	1957	482.7			56.57	43.43	Calculated composition; after 40 hrs annealing.
5	232	L	1957	500.7			56.57	43.43	Calculated composition; after 50 hrs annealing.

DATA TABLE NO. 113 THERMAL CONDUCTIVITY OF [COPPER + PLATINUM] ALLOYS

(Cu + Pt ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 5*	
465.2	0.339	500.7	0.732
CURVE 2*			
483.2	0.523		
CURVE 3*			
481.7	0.565		
CURVE 4*			
482.7	0.644		

* No graphical presentation

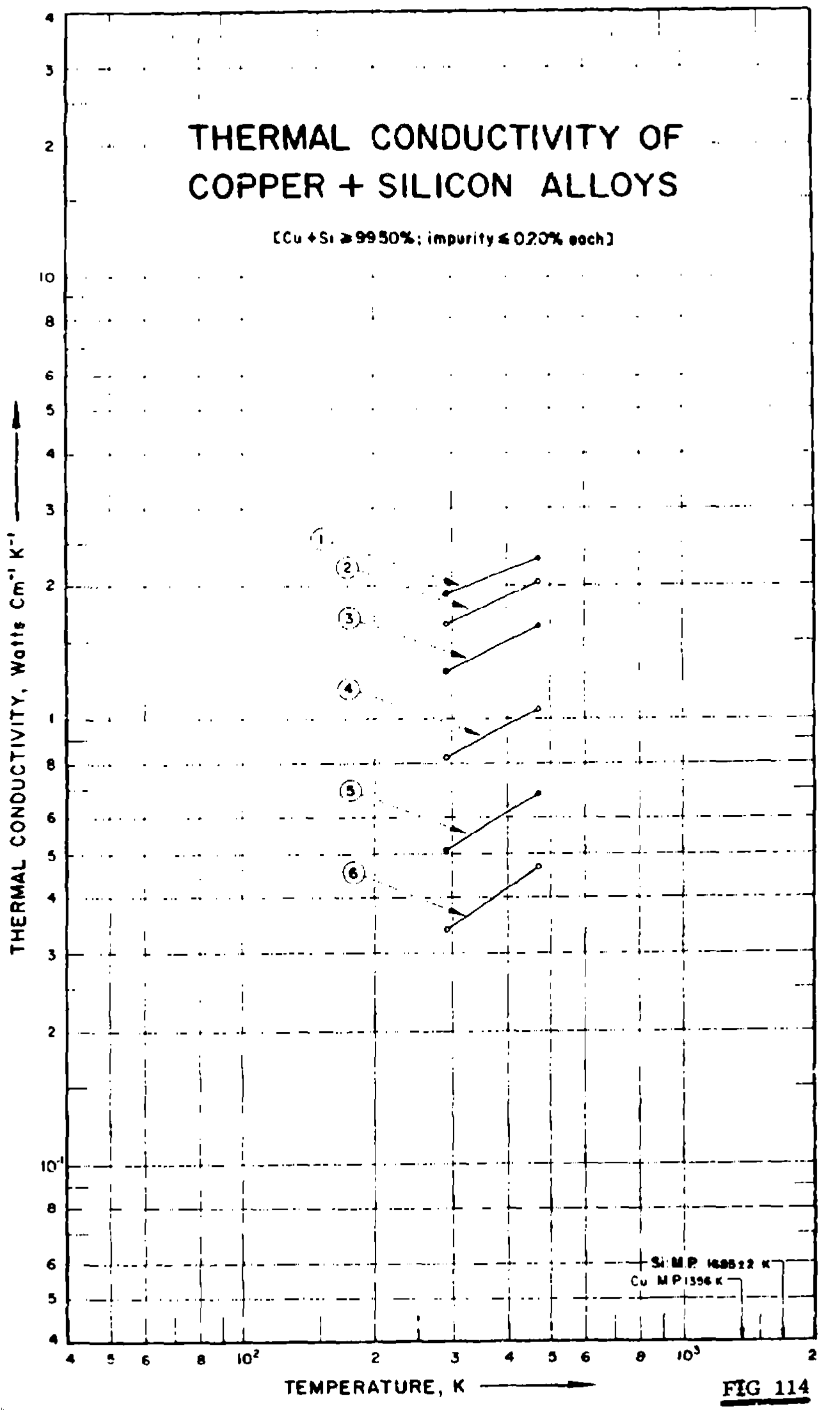

THERMAL CONDUCTIVITY OF
COPPER + SILICON ALLOYS
[Cu + Si ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Si M.P. 1685±2 K
Cu M.P. 1356 K
1
2
3
4
5
6

FIG 114

SPECIFICATION TABLE NO. 114 THERMAL CONDUCTIVITY OF [COPPER + SILICON] ALLOYS

(Cu + Si > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 114]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Si	Composition (continued), Specifications and Remarks
1	135	L	1935	293, 473		105	99.78	0.23	0.02 Fe; specimen 0.75 in. in diameter and 8 in. long; supplied by American Brass Co.; hot rolled, cast and cold drawn to 7/8 in. in diameter; annealed at 700 C for 2 hrs.; electrical conductivity 26.6 and 19.8 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
2	135	L	1935	293, 473		96	99.65	0.32	0.032 Fe, trace Pb; similar to the above specimen except annealed at 700 C for 1 hr.; electrical conductivity 21.71 and 16.98 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
3	135	L	1935	293, 473		106	99.53	0.45	0.03 Fe; similar to the above specimen except annealed at 700 C for 2 hrs.; electrical conductivity 17.19 and 13.96 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
4	135	L	1935	293, 473		78	99.06	1.00	0.03 Fe; similar to the above specimen except electrical conductivity 10.5 and 9.13 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
5	135	L	1935	293, 473		79	98.09	1.98	0.05 Fe; similar to the above specimen except electrical conductivity 6.235 and 5.659 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.
6	135	L	1935	293, 473		80	96.0	3.91	0.02 Fe; similar to the above specimen except electrical conductivity 3.945 and 3.655 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.

DATA TABLE NO. 114 THERMAL CONDUCTIVITY OF [COPPER + SILICON] ALLOYS

(Cu + Si ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
293.2	1.920
473.2	2.301
CURVE 2	
293.2	1.648
473.2	2.038
CURVE 3	
293.2	1.293
473.2	1.623
CURVE 4	
293.2	0.824
473.2	1.059
CURVE 5	
293.2	0.510
473.2	0.686
CURVE 6	
293.2	0.339
473.2	0.469

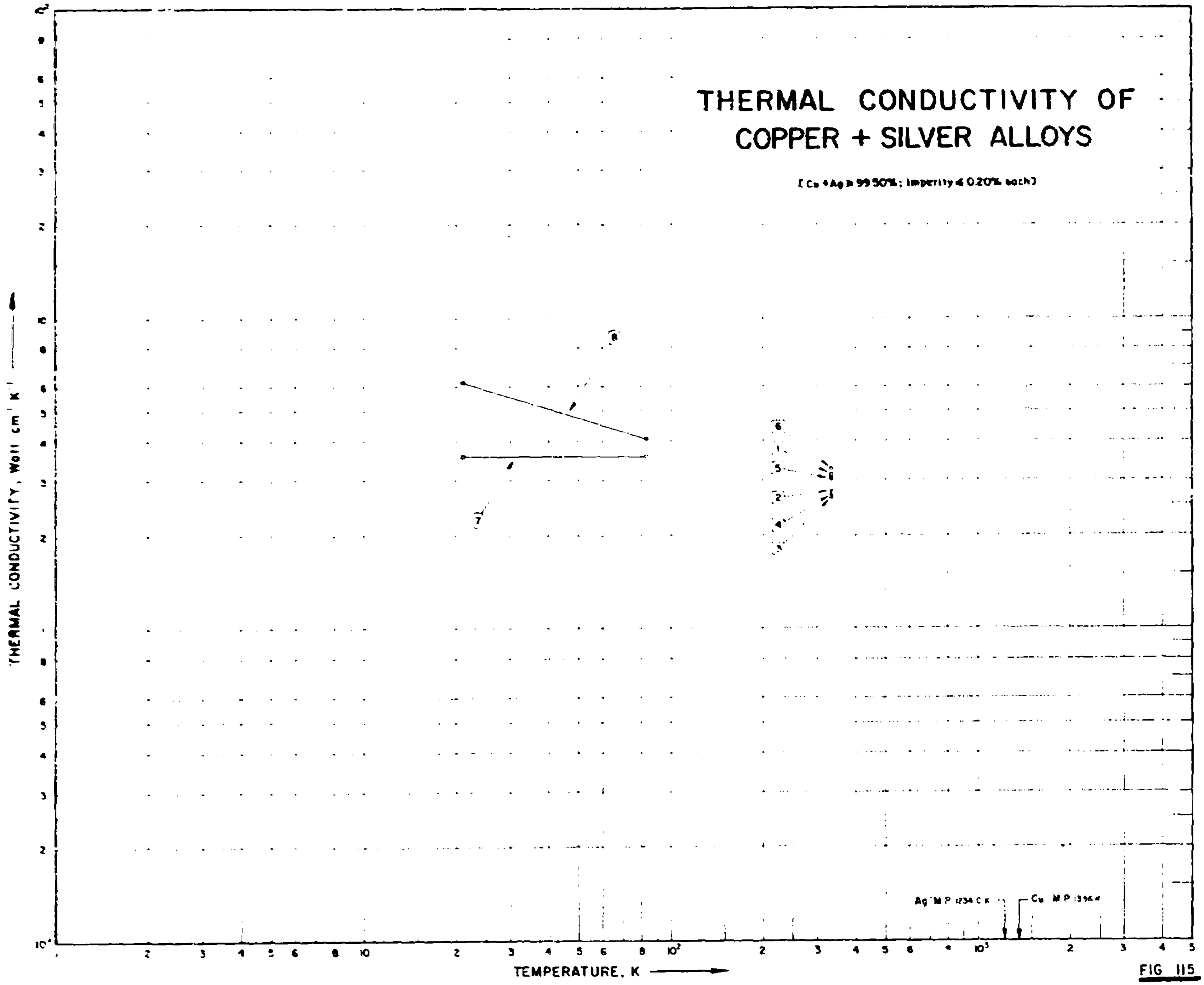

THERMAL CONDUCTIVITY OF
COPPER + SILVER ALLOYS
[Cu + Ag ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ag M.P. 1234 K
Cu M.P. 1356 K

FIG. 115

SPECIFICATION TABLE NO. 115 THERMAL CONDUCTIVITY OF (COPPER + SILVER) ALLOYS

(Cu + Ag ≥ 99.50%, impurity ≤ 0.20% each)

(For Data Reported in Figure and Table No. 115)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Ag	Composition (continued), Specifications and Remarks
1	230	L	1925	335.2			50	50	Approx. composition; specimen ~5 cm long with cross section 0.3 cm²; made from Cu (< 0.03 of total impurity) supplied by Baker, fused with Ag (99.9 pure); electrical conductivity 4.36 x 10^5 ohm^{-1} cm^{-1} at 25 C.
2	230	L	1925	335.2			60	40	Similar to the above specimen except electrical conductivity 3.78 x 10^5 ohm^{-1} cm^{-1} at 25 C.
3	230	L	1925	335.2			70	30	Similar to the above specimen except electrical conductivity 3.59 x 10^5 ohm^{-1} cm^{-1} at 25 C.
4	230	L	1925	335.2			80	20	Similar to the above specimen except electrical conductivity 3.72 x 10^5 ohm^{-1} cm^{-1} at 25 C.
5	230	L	1925	335.2			90	10	Similar to the above specimen except electrical conductivity 4.2 x 10^5 ohm^{-1} cm^{-1} at 25 C.
6	230	L	1925	335.2		Silver bronze	95	5	Similar to the above specimen except electrical conductivity 4.70 x 10^5 ohm^{-1} cm^{-1} at 25 C.
7	57	L	1927	21-83		Silver bronze; Cu 10	97.0	3.0	Specimen 7 cm long and 0.1 to 0.3 cm wide; unannealed; electrical resistivity 1.79, 0.429 and 0.130 μ ohm cm at 0, -190 and -252 C respectively.
8	57	L	1927	21-83		Silver bronze; Cu 10a	97.0	3.0	Similar to the above specimen except annealed at 390 C for 3 hrs.; electrical resistivity 1.724, 0.362 and 0.0697 μ ohm cm at 0, -190 and -252 C respectively.

DATA TABLE NO. 115 THERMAL CONDUCTIVITY OF [COPPER + SILVER] ALLOYS

(Cu + Ag ≥ 99.50%; impurity < 0.20% each)

(Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1})

T	k
CURVE 1	
335.2	3.126
CURVE 2	
335.2	2.753
CURVE 3	
335.2	2.628
CURVE 4	
335.2	2.674
CURVE 5	
335.2	3.025
CURVE 6	
335.2	3.251
CURVE 7	
21.2	3.57
83.2	3.57
CURVE 8	
21.2	6.19
83.2	4.06

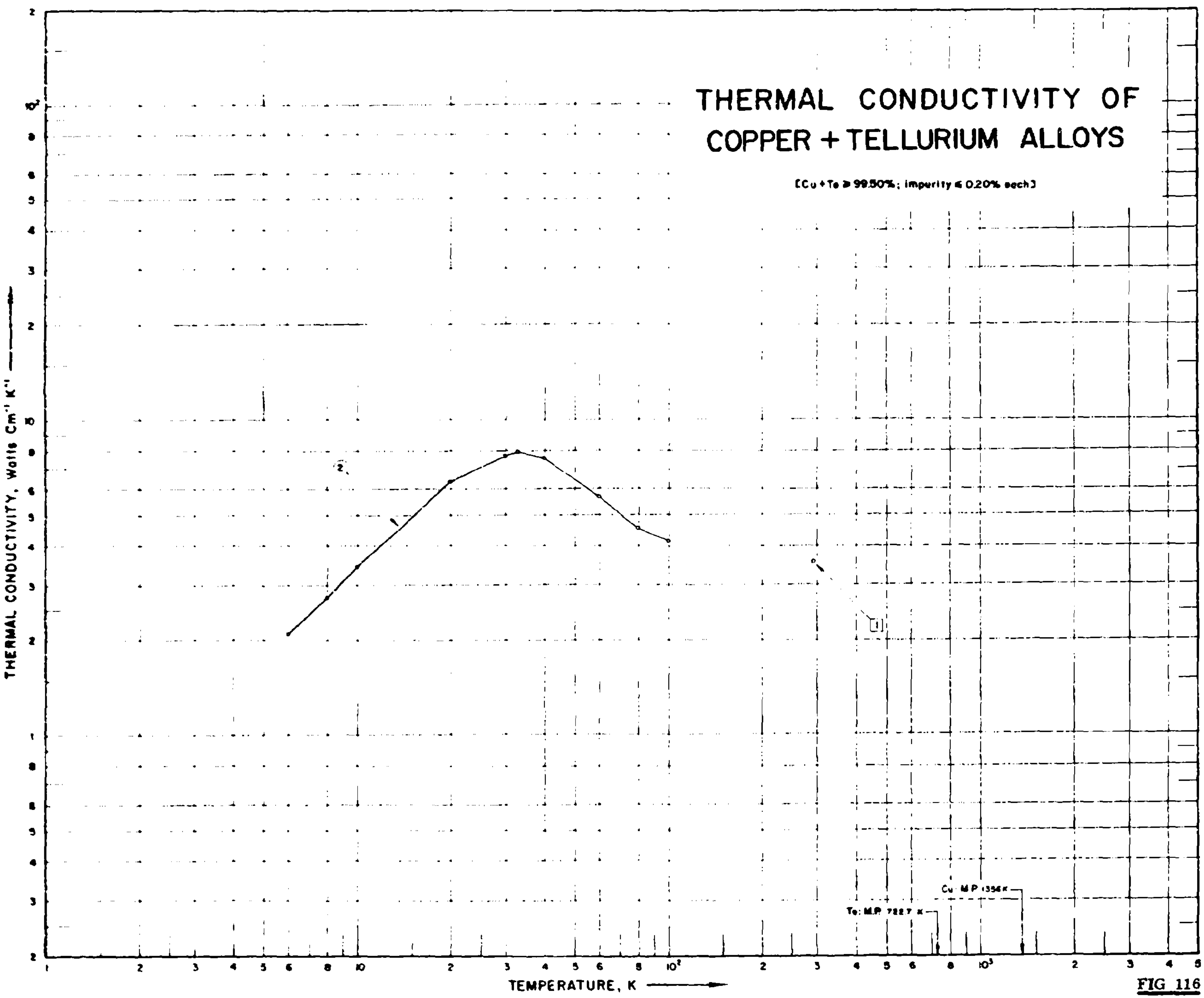

THERMAL CONDUCTIVITY OF COPPER + TELLURIUM ALLOYS
[Cu + Te ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Cu: M.P. 1356 K
Te: M.P. 722.7 K
1
2

FIG 116

SPECIFICATION TABLE NO. 116 THERMAL CONDUCTIVITY OF [COPPER + TELLURIUM] ALLOYS

(Cu + Te > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 116]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Te	Composition (continued), Specifications and Remarks
1	546		1960	293.2		ASTM B301-58T	99.5	0.5	No other details reported.
2	432	L	1957	6.0-100		Free-cutting (Te)Cu	99.424	0.56	0.007 P, 0.001 Fe, 0.001 Si, 0.001 Ag, 0.001 Zn, < 0.001 Al, Pb, Mg, Mn, and Sn each; commercial hard tempered rod; specimen ground down from a 0.25 in. dia rod; average grain size 0.1 x 0.016 mm longitudinally and 0.016 x 0.016 mm transversely; density 8.909 g cm^{-3}.

DATA TABLE NO. 116 THERMAL CONDUCTIVITY OF [COPPER + TELLURIUM] ALLOYS

(Cu + Te ≥ 99.70%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
293.2	[illegible]
CURVE 2	
6.0	2.19
8.0	2.73
10	3.43
20	6.35
[illegible]	7.50
35	[illegible]
40	7.60
60	5.68
80	4.55
100	4.1[illegible]

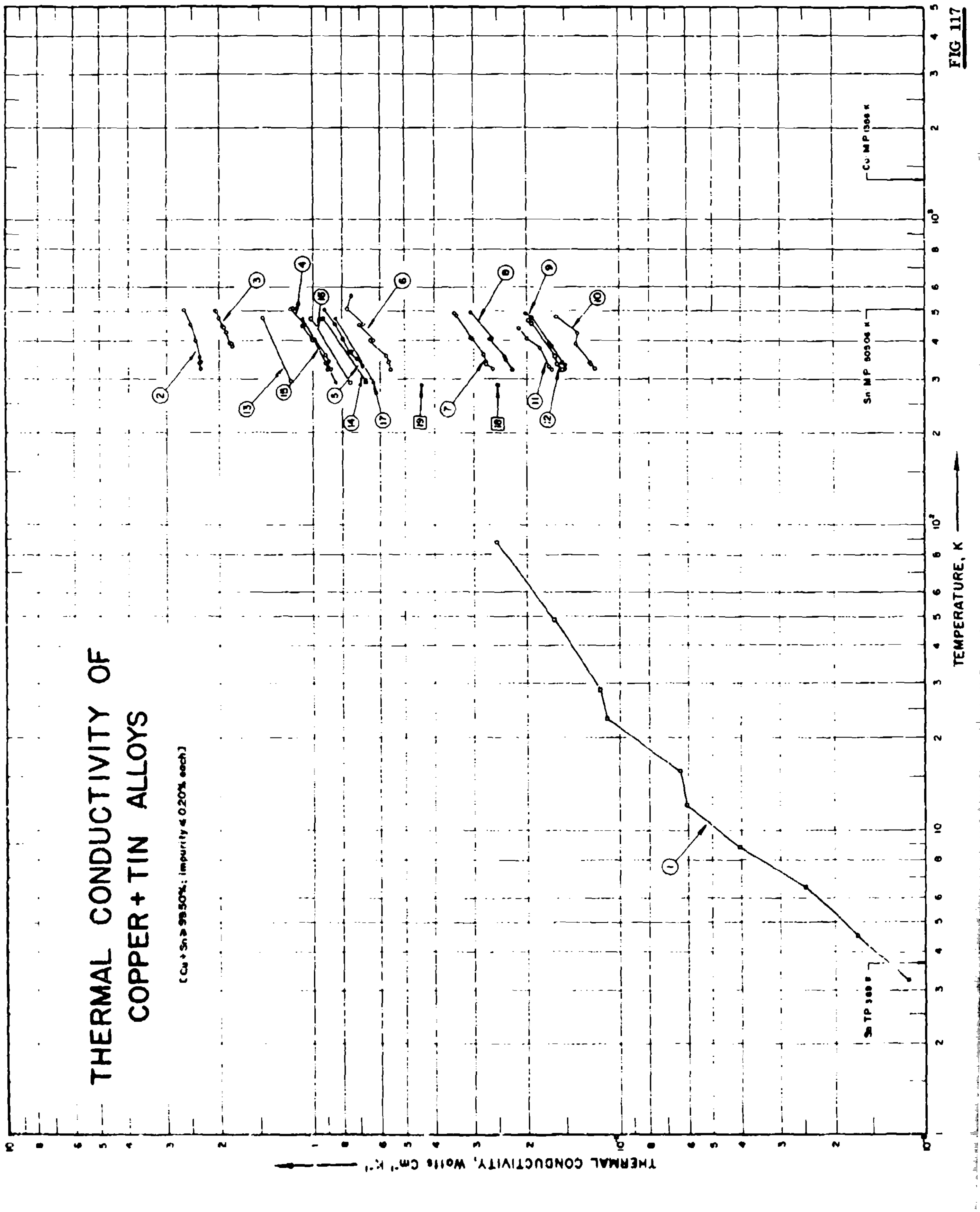

THERMAL CONDUCTIVITY OF
COPPER + TIN ALLOYS
[Cu + Sn ≥ 99.50%; Impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Sn TP 380 K
Sn MP 505.06 K
Cu MP 1358 K

FIG 117

SPECIFICATION TABLE NO. 117 THERMAL CONDUCTIVITY OF [COPPER + TIN] ALLOYS

(Cu + Sn 99.50%; impurity 0.20% each)

[For Data Reported in Figure and Table No. 117]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Sn	Composition (continued), Specifications and Remarks
1	134	L	1956	3.2-88	5.0	Phosphor bronze, 5	93.30	6.46	0.2 P; unannealed.
2	134	L	1931	324-507	2.0	74	99.00	0.99	0.002 P, 0.01 Fe, trace Pb; cold-rolled to 7/8 in. in diameter and annealed at 650 C then slowly cooled; electrical conductivity 31.364 x 10^4 ohm^{-1} cm^{-1} at 20 C.
3	134	L	1931	383-503	2.0	75	98.06	1.92	0.01 P, 0.01 Fe, trace Pb; specimen supplied by American Brass Co.; high grade commercial alloy, cast in a mold of 2-1/4 in. in diameter; cold-rolled and annealing to 7/8 in. in diameter at 650 C for 30 min then slowly cooled; electrical conductivity 21.154 x 10^4 ohm^{-1} cm^{-1} at 20 C.
4	134	L	1932	323-511	2.0	41	94.96	4.92	0.06 P, 0.05 Fe, 0.01 Pb; similar to the above specimen except electrical conductivity 10.674 x 10^4 ohm^{-1} cm^{-1} at 20 C.
5	134	L	1931	331-509		43	92.45	7.48	0.04 P, 0.02 Fe, 0.01 Pb; similar to the above specimen except electrical conductivity 7.8945 x 10^4 ohm^{-1} cm^{-1} at 20 C.
6	134	L	1931	323-562		44	89.51	10.40	0.03 P, 0.05 Fe, 0.01 Pb; similar to the above specimen except electrical conductivity 6.4362 x 10^4 ohm^{-1} cm^{-1} at 20 C.
7	515	C	1952	323-492		Bronze; A_1	89.0	11.0	Specimen mean thickness 0.882 cm and 8.87 cm long; prepared by powder metallurgy method from powder of mean particle size of 0.00133 cm diameter; supplied by Messrs. Sintered Products; density 6.45 g cm^{-3}; electrical resistivity 33.0 μohm cm at 20 C, porosity 25.8 %.
8	515	C	1952	323-493		Bronze; B_1	89.0	11.0	Specimen mean thickness 0.889 cm and 8.89 cm long; pre-prepared by powder metallurgy method; mean particle size 0.00493 cm; supplied by Messrs.Sintered Products; density 6.30 g cm^{-3}; electrical resistivity 38.5 μ ohm cm at 20 C; porosity 28.2%.
9	515	C	1952	323-491		Bronze;B_1'	89.0	11.0	Specimen 0.85 cm^2 cross section and 7.6 cm long; prepared by powder metallurgy method; mean particle size 0.00493 cm; supplied by Messrs. Sintered Products; density 5.85 g cm^{-3}; electrical resistivity 57.1 μohm cm at 20 C; porosity 32.7 %.

SPECIFICATION TABLE NO. 117 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Sn	Composition (continued), Specifications and Remarks
10	515	C	1952	323-469		Bronze; C_1	89.0	11.0	Specimen mean thickness 0.948 cm and 8.88 cm long; prepared by powder metallurgy method; mean particle size; 0.01275 cm; supplied by Messrs. Sintered Products; density 5.55 g cm^{-3}; electrical resistivity 81.5 μohm cm at 20 C; porosity 36.2%.
11	515	C	1952	323-438		Bronze; D_1	89.0	11.0	Specimen mean thickness 0.932 cm and 8.89 cm long; prepared by powder metallurgy method; mean particle size 0.02113 cm; supplied by Messrs. Sintered Products; density 5.75 g cm^{-3}; electrical resistivity 52.0 μohm cm at 20 C; porosity 34.5%.
12	515	C	1952	323-463		Bronze; E_1	89.0	11.0	Specimen mean thickness 0.945 cm and 8.89 cm long; prepared by powder metallurgy method; mean particle size;0.04 cm; supplied by Messrs. Sintered Products; density 5.50 g cm^{-3}; electrical resistivity 60.1 μohm cm at 20 C; porosity 36.8%.
13	516	L	1941	293, 473		Phosphor bronze; 1	96.84	3.11	0.02 P, <0.01 Fe, <0.01 Ni, <0.005 Pb, <0.005 Sb; cast, after air cooling annealed at 625 C then cold-rolled and machined; electrical resistivity 6.37 μohm cm at 20 C.
14	516	L	1941	293, 473		Phosphor bronze; 3	92.6	7.31	0.02 P, <0.01 Fe, <0.005 Pb, <0.005 Sb; cast after air cooling, annealed at 625 C, hot-rolled at 300 C and annealed at 625 C for 2-1/2 hrs, again hot-rolled at 300 C and annealed at 625 C for 2-1/2 hrs then cold-rolled and machined; electrical resistivity 12.31 μohm cm at 20 C.
15	516	L	1941	293, 473		Phosphor bronze; 6	94.6	5.27	0.09 P, <0.001 Fe, <0.005 Pb, <0.005 Sb; similar to the above specimen except electrical resistivity 10.25 μohm cm at 20 C.
16	516	L	1941	293, 473		Phosphor bronze; 7	93.9	6.65	0.12 P, <0.01 Fe, <0.01 Zn, <0.005 Pb, <0.005 Sb; similar to the above specimen except electrical resistivity 12.83 μohm cm at 20 C.
17	516	L	1941	293, 473		Phosphor bronze; 5	96.16	3.71	0.12 P, <0.01 Fe, <0.01 Zn, <0.005 Pb, <0.005 Sb; cast, after air cooling; annealed at 625 C then cold-rolled and machined.
18	459	R	1905	296.7		Sn_{25} Cu_{75}	75.55	24.45	Cast and turned; density 8.89 g cm^{-3} at 14 C.
19	459	R	1905	296.7		Sn_{10} Cu_{90}	90.1	9.9	Cast and turned; density 8.475 g cm^{-3} at 14 C.

DATA TABLE NO. 117 THERMAL CONDUCTIVITY OF [COPPER + TIN] ALLOYS

(Cu + Sn ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

CURVE 1

T	k
3.24	0.0131
4.50	0.0167
6.52	0.0247
8.80	0.0404
12.1	0.0603
15.7	0.0636
23.3	0.110
29.0	0.116
49.0	0.163
88.0	0.251

CURVE 2

T	k
324.2	2.33
324.2	2.34
340.2	2.34
340.2	2.35
356.2	2.36
356.2	2.36
400.2	2.44
402.2	2.43
450.2	2.54
453.2	2.53
505.2	2.65
507.2	2.63

CURVE 3

T	k
383.2	1.83
395.2	1.84
396.2	1.87
429.2	1.92
445.2	1.95
447.2	1.96
479.2	2.01
500.2	2.05
503.2	2.08

CURVE 4

T	k
323.2	0.891
324.2	0.870
341.2	0.904
342.2	0.883
360.2	0.910
402.2	1.00
403.2	0.987
452.2	1.08
453.2	1.06
510.2	1.18
511.2	1.15

CURVE 5

T	k
331.2	0.678
332.2	0.686
350.2	0.716
369.2	0.762
370.2	0.749
405.2	0.795
453.2	0.858
454.2	0.849
455.2	0.849
509.2	0.916

CURVE 6

T	k
333.2	0.552
341.2	0.561
360.2	0.573
401.2	0.649
403.2	0.628
452.2	0.703
453.2	0.682
512.2	0.770
562.2	0.749

CURVE 7

T	k
323.2	0.257
335.7	0.270
340.7	0.272
360.2	0.276
402.2	0.300
407.2	0.305
481.2	0.347
492.2	0.342

CURVE 8

T	k
323.2	0.222
345.7	0.234
355.2	0.236
403.2	0.264
40[illegible].2	0.259
493.2	0.304

CURVE 9

T	k
323.2	0.149
333.2	0.149
339.2	0.153
385.2	0.165
390.7	0.167
476.2	0.192
490.7	0.201

CURVE 10

T	k
323.2	0.119
335.7	0.123
338.2	0.124
387.7	0.137
424.2	0.136
469.2	0.159

CURVE 11

T	k
323.2	0.165
328.2	0.167
377.2	0.180
405.7	0.199
438.2	0.211

CURVE 12

T	k
323.2	0.151
335.7	0.157
355.7	0.161
455.7	0.193
463.2	0.197

CURVE 13

T	k
293.2	1.17
473.2	1.46

CURVE 14

T	k
293.2	0.669
473.2	0.920

CURVE 15

T	k
293.2	0.837
473.2	1.08

CURVE 16

T	k
293.2	0.753
473.2	1.00

CURVE 17

T	k
293.2	0.628
473.2	0.837

CURVE 18

T	k
286.7	0.247

CURVE 19

T	k
286.7	0.140

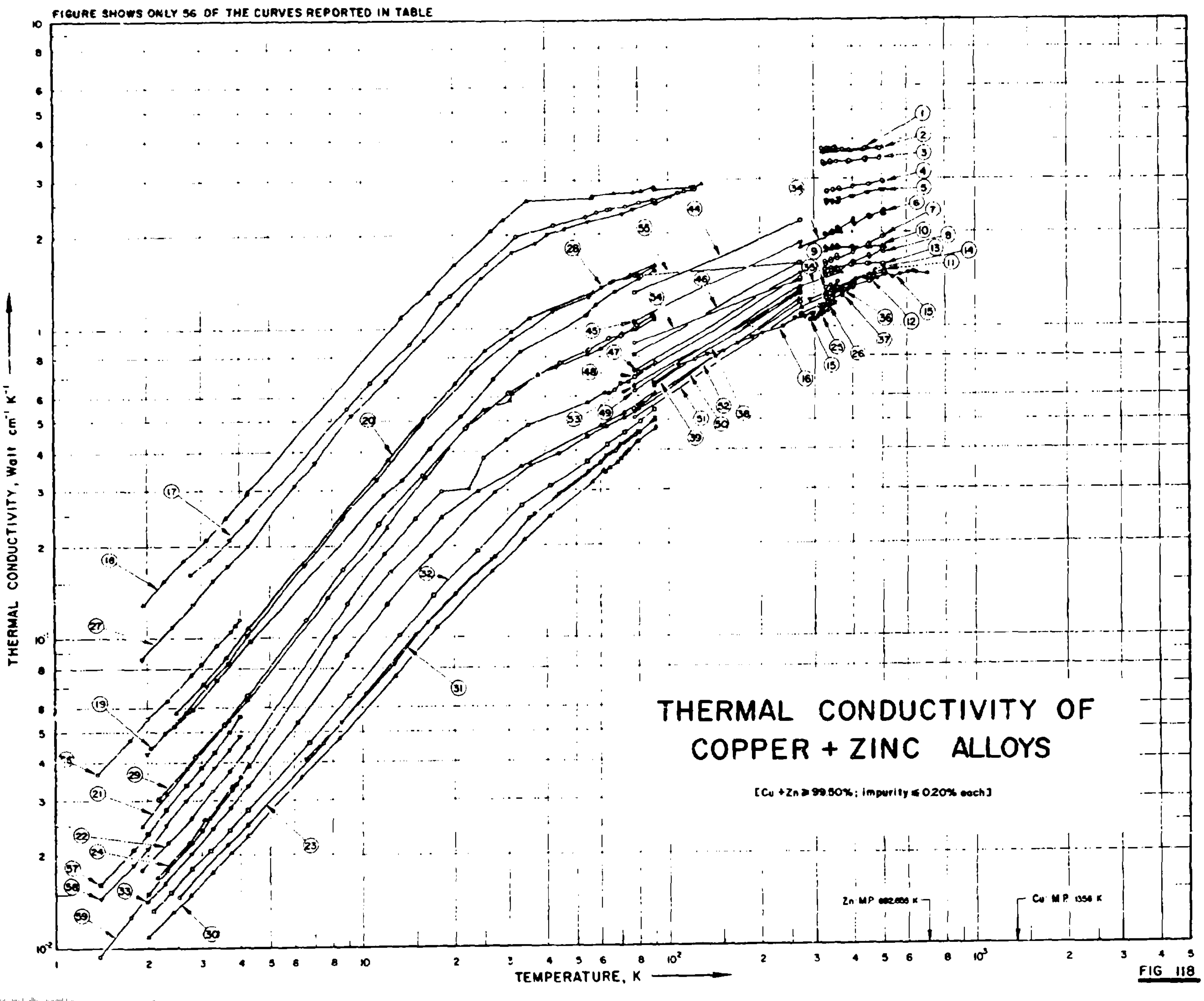


FIGURE SHOWS ONLY 56 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF COPPER + ZINC ALLOYS
[Cu + Zn ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Zn M.P. 692.655 K
Cu M.P. 1356 K

FIG. 118

SPECIFICATION TABLE NO. 118 THERMAL CONDUCTIVITY OF [COPPER + ZINC] ALLOYS

(Cu + Zn ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 118]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Zn	Composition (continued), Specifications and Remarks
1	133	L	1930	319-494		90	99.64	0.35	0.02 Fe, 0.01 Pb; polycrystalline grain dia 0.070 mm; specimen ~13.25 in. long, 0.750 in. dia; annealed at 650 C for 1 hr; electrical conductivity 55.264 x 10^4 ohm^{-1} cm^{-1} at 20 C.
2	133	L	1930	323-501	2	89	99.45	0.51	0.01 Fe, 0.01 Pb; polycrystalline, grain dia 0.110 mm; specimen ~13.25 in.long, 0.750 in.dia; annelaed at 650 C for 1 hr; electrical conductivity 53.325 x 10^4 ohm^{-1} cm^{-1} at 20 C.
3	133	L	1930	324-493	2	73	88.93	0.95	0.02 Fe; polycrystalline grain dia 0.120 mm; specimen ~13.25 in.long, 0.750 in. dia; annealed at 700 C for 1 hr; electrical conductivity 47.685 x 10^4 ohm^{-1} cm^{-1} at 20 C.
4	133	L	1930	332-505	2	12	96.94	3.04	0.02 Fe; polycrystalline, grain dia 0.100 mm; specimen ~13.25 in. long, 0.750 in. dia; annealed at 700 C for 0.75 hr; electrical conductivity 36.607 x 10^4 ohm^{-1} cm^{-1} at 20 C.
5	133	L	1930	329-506	2	13	95.21	4.77	Similar to the above specimen except grain dia 0.085 mm; electrical conductivity 33.962 x 10^4 ohm^{-1} cm^{-1} at 20 C.
6	133	L	1930	328-509	2	14	90.07	9.91	0.01 Fe, 0.01 Pb; polycrystalline, grain dia 0.095 mm; specimen ~13.25 in. long, 0.750 in. dia; annealed at 700 C for 0.75 hr; electrical conductivity 25.293 x 10^4 ohm^{-1} cm^{-1} at 20 C.
7	133	L	1930	326-504	2	15	83.20	16.76	0.03 Fe, 0.01 Pb; polycrystalline, grain dia 0.125 mm; specimen ~13.25 in. long, 0.750 in. dia; annealed at 700 C for 0.75 hr; electrical conductivity 20.108 x 10^4 ohm^{-1} cm^{-1} at 20 C.
8	133	L	1930	327-509	2	16	79.62	20.35	0.01 Fe, 0.02 Pb; polycrystalline, grain dia 0.190 mm; specimen ~13.25 in. long, 0.750 in. dia; annealed at 700 C for 0.75 hr; electrical conductivity 18.459 x 10^4 ohm^{-1} cm^{-1} at 20 C.
9	133	L	1930	325-512	2	22	59.20	40.75	0.02 Fe, 0.03 Pb; polycrystalline, grain dia 0.070 mm; specimen ~13.25 in. long, 0.750 in. dia; annealed at 650 C for 3 hr; electrical conductivity 16.700 x 10^4 ohm^{-1} cm^{-1} at 20 C.

SPECIFICATION TABLE NO. 118 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Zn	Composition (continued), Specifications and Remarks
10	133	L	1930	329-508	2	85	50.30	49.49	0.01 Fe, 0.04 Pb; polycrystalline, grain dia 16mm; specimen ~13.25 in. long, 0.750 in. dia; annealed at 650 C for 2 hr; electrical conductivity 25.812 x 10^4 ohm^{-1} cm^{-1} at 20 C.
11	133	L	1930	329-512	2	18	69.14	30.81	0.03 Fe, 0.02 Pb; polycrystalline, grain dia 0.075 mm; specimen ~13.25 in. long, 0.750 in dia; annealed at 650 C for 0.75 hr; electrical conductivity 15.857 x 10^4 ohm^{-1} cm^{-1} at 20 C.
12	133	L	1930	329-511	2	21	65.43	34.53	0.01 Fe, 0.03 Pb; polycrystalline; grain dia 0.080 mm; specimen ~13.25 in. long, 0.750 in. dia; annealed at 650 C for 0.75 hr; electrical conductivity 15.325 x 10^4 ohm^{-1} cm^{-1} at 20 C.
13	133	L	1930	326-505	2	88	54.96	45.02	0.01 Fe; polycrystalline; grain dia 0.040 mm; specimen ~13.25 in. long, 0.750 in. dia; annealed at 650 C for 2 hr; electrical conductivity 20.466 x 10^4 ohm^{-1} cm^{-1} at 20 C.
14	135	L	1935	293,473		19	66.24	33.72	0.01 Fe, 0.03 Pb; annealed at 700 C.
15	6	L	1931	351-703		Brass 70/30	70	30	Approx. composition; specimen ~7.5 cm long, 0.585 cm dia; density 8.44 g cm^{-3} at 22 C.
16	88		1908	108-298		Brass 70/30	70	30	Specific gravity 8.44 at 22 C.
17	234	L	1957	2.8-123	1	25	98.37	1.63	Specimen ~8 cm long, 0.5 cm dia; supplied by Johnson, Matthey and Co. Ltd; drawn; ρ_0 = 0.425 μohm cm.
18	234	L	1957	2.0-130	1	2	98.37	1.63	The above specimen annealed at 500 C for 4 hr in a He atmosphere; ρ_0 = 0.38 μohm cm.
19	234	L	1957	2.1-91	1	55	94.63	5.37	Specimen ~8 cm long, 0.5 cm dia; supplied by Johnson, Matthey and Co. Ltd; drawn; ρ_0 = 1.22 μohm cm.
20	234	L	1957	2.5-91	1	5	94.63	5.37	The above specimen annealed at 500 C for 4 hr in a He atmosphere; ρ_0 = 1.12 μohm cm.
21	234	L	1957	1.9-91	1	10	90.02	9.98	Specimen ~8 cm long, 0.5 cm dia; supplied by Johnson, Matthey and Co. Ltd; drawn; annealed in a He atmosphere at 500 C for 4 hr; ρ_0 = 1.88 μohm cm.
22	234	L	1957	1.9-91	1	20	80.52	19.48	Similar to the above specimen except ρ_0 = 2.97 μohm cm.

SPECIFICATION TABLE NO. 118 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Zn	Composition (continued), Specifications and Remarks
23	234	L	1957	2.5-91	1	30S	68.13	31.87	Specimen 8 cm long, 0.5 cm dia; supplied by Johnson, Matthey and Co. Ltd; drawn; ρ_0 4.31 μohm cm.
24	234	L	1957	2.2-91	1	30	68.13	31.87	The above specimen annealed in a He atmosphere at 500 C for 4 hr; ρ_0 3.60 μohm cm.
25	235	L	1944	302-335		Brass			Specimen 2.565 cm long, cross sectional area 5.017cm^2.
26	235	L	1944	314-344		Brass			Specimen 2.570 cm long, cross sectional area 3.447cm^2.
27	233	L	1957	1.9-121			~~98~~ 97.74	~~2~~ 2.26	Approx. composition specimen 8 cm long, 0.5 cm dia; drawn, annealed at 850 C for 4 hr; ρ_0 0.56 μohm cm.
28	233	L	1957	2.0-91			~~95~~ 94.84	~~5~~ 5.16	Similar to the above specimen except ρ_0 1.20 μohm cm.
29	233	L	1957	2.2-91		Commercial bronze	~~90~~ 89.74	~~10~~ 10.26	Similar to the above specimen except ρ_0 1.94 μohm cm.
30	236	L	1959	2.0-91		1	68	32	Approx. composition; α brass; machined from an annealed and torsionally deformed bar.
31	236	L	1959	6.5-91		2	68	32	Similar to the above specimen but annealed (after machining) up to 250 C at a rate of 6 C min^{-1}.
32	236	L	1959	2.1-91		3	68	32	Similar to the above specimen but annealed (after machining) up to 290 C at a rate of 6 C min^{-1}.
33	236	L	1959	2.0-91		4	68	32	Similar to the above specimen but annealed (after machining) up to 400 C at a rate of 6 C min^{-1}.
34	246	T	1919	273,373			92.65	7.35	Rolled and drawn; annealed close to the melting point for 1/2 hr.
35	246	T	1919	273,373			85.65	14.35	Similar to the above specimen.
36	246	T	1919	273,373			72.11	27.89	Similar to the above specimen.
37	246	T	1919	273,373			66.97	33.03	Similar to the above specimen.
38	425	L	1924	90,273		Red brass	82.	18	Polycrystalline; fine grained.
39	425	L	1924	90,273		Red brass	82	18	Polycrystalline; coarse grained.
40	517	L	1959	2.3-4.4		Brass	85	15	α brass; prepared from Johnsen, Matthey spectrographically standardized metals; specimen 2.5 mm dia, 4 cm long; annealed just below melting point for 40 hr.
41	517	L	1959	2.3-4.5		Brass	85	15	The above specimen drawn to produce 4.6% strain.

SPECIFICATION TABLE NO. 118 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Zn	Composition (continued), Specifications and Remarks
42	517	L	1959	2.4-4.5		Brass	85	15	The above specimen drawn to produce 10.4% strain.
43	517	L	1959	2.3-4.4		Brass	85	15	The above specimen drawn to produce 19.8% strain.
44	440	L,R	1940	78,273		1	95.429	4.540	α-brass with impurities of: 0.014 Sb, 0.010 Fe, 0.007 S, and trace As; calculated composition; annealed in N_2 for 20 hr at 380-400 C.
45	440	L,R	1940	78,273		2	92.791	7.180	Similar to the above specimen except 0.014 Sb, 0.009 Fe, 0.006 S and trace As.
46	440	L,R	1940	78,273		3	86.842	13.130	Similar to the above specimen except 0.013 Sb, 0.009 Fe, 0.006 S, and trace As.
47	440	L,R	1940	78,273		4	82.551	17.420	Similar to the above specimen except 0.012 Sb, 0.008 Fe, 0.006 S, and trace As.
48	440	L,R	1940	78,273		5	79.704	20.270	Similar to the above specimen.
49	440	L,R	1940	78,273		6	75.716	24.560	Similar to the above specimen except 0.011 Sb, 0.008 Fe, 0.005 S, and trace As.
50	440	L,R	1940	78,273		7	69.978	30.000	Similar to the above specimen except 0.011 Sb, 0.007 Fe, 0.005 S, and trace As.
51	440	L,R	1940	78,273		8	64.030	35.95	Similar to the above specimen except 0.010 Sb, 0.006 Fe, 0.004 S, and trace As.
52	440	L,R	1940	78,273		9	62.281	37.700	α+β brass; impurities: 0.009 Sb, 0.006 Fe, 0.004 S, and trace As; calculated compositions; annealed in N_2 at 380-400 C for 20 hr.
53	440	L,R	1940	78,273		10	59.911	40.070	Similar to the above specimen.
54	440	L,R	1940	78,273		11	55.602	44.38	Similar to the above specimen except 0.008 Sb, 0.006 Fe, 0.004 S, and trace As.
55	440	L,R	1940	78,273		12	51.073	48.910	β-brass; impurities: 0.008 Sb, 0.005 Fe, 0.004 S, and trace As; calculated composition; annealed in N_2 at 380-400 C for 20 hr.
56	518	L	1960	1.4-4.0	±5	Z4	95.4	4.59	0.01 Pb; annealed for 21 hr at 540 C; electrical resistivity 1.13 and 1.08 μ ohm cm at 1.05 and 4.2 K, respectively.
57	518	L	1960	1.4-4.0	±5	Z15	84.53	15.43	0.02 Fe, 0.02 Pb; annealed for 21 hr at 540 C; electrical resistivity 2.55 and 2.36 μ ohm cm at 1.05 and 4.2 K, respectively.

SPECIFICATION TABLE NO. 118 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Zn	Composition (continued), Specifications and Remarks
58	518	L	1960	1.4-4.0	±5	Z20	86.56	13.43	0.01 Fe, coldworked; annealed at 500 C for 17 hr; electrical resistivity 2.73 and 2.58 μohm cm at 1.05 and 4.2 K, respectively.
59	518	L	1960	1.4-4.0	±5	Z30	69.95	30.02	0.02 Fe, 0.01 Pb; annealed for 21 hr at 540 C; electrical resistivity 4.22 and 4.10 μohm cm at 1.05 and 4.2 K, respectively.

DATA TABLE NO. 118 THERMAL CONDUCTIVITY OF [COPPER + ZINC] ALLOYS

(Cu + Zn ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
319.4	3.7[illegible]9
325.0	3.690
332.4	3.715
335.0	3.705
340.0	3.700
350.4	3.707
354.4	3.728
355.0	3.699
373.5	3.699
393.1	3.690
394.9	3.690*
441.4	3.715
443.9	3.711
493.5	3.732
CURVE 2	
323.2	3.653
324.2	3.590
326.2	3.642
338.2	3.642
341.2	3.674
352.2	3.678
352.2	3.653*
356.2	3.669
395.2	3.673
398.2	3.669
443.2	3.711
444.2	3.690*
449.2	3.694*
455.2	3.724
492.2	3.745*
501.2	3.720
CURVE 3	
324.2	3.356
325.2	3.314
326.2	3.322
340.2	3.372
341.2	3.326
342.2	[illegible]
CURVE 3 (cont.)	
357.2	3.360
358.2	3.360*
392.2	3.389
393.2	3.372
394.2	3.385
441.2	3.423
442.2	3.406
443.2	3.423
492.2	3.454
493.2	3.464
CURVE 4	
332.0	2.732
332.1	2.720
348.1	2.749
348.2	2.732
364.5	2.766
364.6	2.745
401.5	2.795
403.2	2.807
452.0	2.862
453.1	2.862
505.1	2.937
505.2	2.929
CURVE 5	
328.9	2.498
329.4	2.544
330.2	2.473
330.4	2.469*
344.5	2.527
345.2	2.502
345.4	2.473
359.8	2.469
360.5	2.561
360.9	2.477
361.2	2.531
398.2	2.611
402.2	2.617
446.0	2.6[illegible]2
CURVE 5 (cont.)	
453.2	2.684
495.5	2.749
505.2	2.757
506.2	2.753
CURVE 6	
328.2	1.958
332.5	1.946
344.2	1.970
346.4	1.992
346.5	1.983
360.2	1.986
362.6	2.042
362.1	2.033
404.4	2.155
405.4	2.159
406.2	2.127
407.8	2.121
453.8	2.234
454.8	2.234
455.2	2.192
456.2	2.192*
456.5	2.213
507.0	2.322
507.2	2.264
508.0	2.326
508.2	2.255
509.5	2.310
CURVE 7	
326.1	1.615
328.2	1.565
342.0	1.653
343.6	1.607
358.7	1.690
359.8	1.649
402.8	1.728
403.7	1.736
450.5	1.816
451.1	1.824
CURVE 7 (cont.)	
503.9	1.916
504.0	1.920
CURVE 8	
327.4	1.481
327.8	1.448
343.6	1.502
344.0	1.469
360.3	1.522
360.7	1.494
405.7	1.611
408.2	1.607
454.5	1.690
456.6	1.669
507.9	1.757
509.4	1.741
CURVE 9	
325.8	1.251
326.0	1.322
342.3	1.351
342.8	1.280
359.2	1.381
359.4	1.310
402.4	1.381
405.5	1.368
454.1	1.455
456.4	1.423
509.8	1.494
511.8	1.485*
CURVE 10	
328.5	1.749
329.0	1.778
330.0	1.774
344.0	1.762
344.2	1.787
345.0	1.778
359.4	1.795
CURVE 10 (cont.)	
359.6	1.770
360.1	1.782
399.2	1.782
403.4	1.766
452.8	1.766
456.2	1.749
505.4	1.749
508.0	1.736
CURVE 11	
329.4	1.259
345.9	1.289
363.1	1.322
406.0	1.377
456.1	1.439
511.5	1.510
CURVE 12	
329.0	1.222
344.3	1.264
360.5	1.310
403.6	1.322
404.[illegible]	1.343
453.8	1.393
451.3	1.414
510.2	1.477
510.5	1.498*
CURVE 13	
326.1	1.519
341.7	1.536
311.8	1.510
357.2	1.521
395.4	1.577
399.1	1.582
448.5	1.586
451.9	1.586
502.2	1.594
504.8	1.586
CURVE 14	
293.2	1.201
473.2	1.460
CURVE 15	
351.2	1.276
367.2	1.280
372.2	1.326
386.2	1.301
394.2	1.351
413.2	1.406
437.2	1.423
44[illegible].2	1.410
451.2	1.431
511.2	1.494
541.2	1.431
571.2	1.456
619.2	1.494
634.2	1.502
648.2	1.477
703.2	1.464
CURVE 16	
108.2	0.745
123.2	0.778
135.2	0.808
152.2	0.833
170.2	0.887
188.2	0.925
204.2	0.954
238.2	1.004
260.2	1.054
281.2	1.059
296.2	1.096
298.2	1.092
CURVE 17	
2.782	0.1604
3.215	0.1804
3.718	0.2103
CURVE 17 (cont.)	
4.279	0.2403
9.01	0.5507
10.69	0.6738
14.51	0.890
18.25	1.295
19.60	1.268
25.84	1.625
32.20	1.980
42.96	2.120
54.60	2.270
59.00	2.350
64.00	2.380
65.40	2.400
73.20	2.450
81.30	2.510
90.90	2.560
91.00	2.560
108.30	2.710
114.30	2.760
122.60	2.790
CURVE 18	
1.95	0.129
2.277	0.152
2.65	0.178
3.135	0.210
3.63	0.245
4.266	0.293
4.29	0.297
13.55	1.090
16.70	1.300
20.30	1.610
26.60	2.060
29.36	2.240
35.00	2.560
56.99	2.620
57.02	2.660
67.12	2.720
77.45	2.737
82.19	2.760
91.10	2.854
CURVE 18 (cont.)	
91.20	2.800
91.30	2.780
123.40	2.840
129.80	2.910
CURVE 19	
2.05	0.0443
2.45	0.0523
2.83	0.0597
3.37	0.9733
4.33	0.0972
11.76	0.287
13.55	0.325
16.71	0.409
21.13	0.518
27.01	0.681
33.10	0.823
54.40	1.098
58.60	1.170
67.40	1.280
80.90	1.424
91.00	1.505
CURVE 20	
2.48	0.0579
3.04	0.0717
3.61	0.0867
4.29	0.1065
12.25	0.377
16.00	0.510
20.25	0.665
25.50	0.842
31.00	0.977
35.60	1.073
57.65	1.290
65.35	1.374
75.90	1.458
91.00	1.594

* Not shown on plot

DATA TABLE NO. 11S (continued)

CURVE 21

T	k
1.916	0.0248
2.324	0.0314
2.687	0.0383
3.670	0.0543
4.24	0.0632
7.74	0.1337
12.14	0.2263
16.24	0.330
22.30	0.481
25.10	0.549
30.60	0.586
31.30	0.618
37.90	0.701
43.20	0.740
54.80	0.816
60.40	0.850
69.90	0.938
71.00	0.960
78.70	0.985
90.70	1.059
90.70	1.067

CURVE 22

T	k
1.91	0.0177
2.333	0.0220
2.775	0.0263
3.26	0.0323
3.70	0.0375
4.27	0.0446
8.98	0.1286
11.85	0.188
15.01	0.2405
18.28	0.297
22.50	0.3041
25.10	0.382
29.90	0.434
35.10	0.482
54.90	0.573
62.30	0.616
64.60	0.615
67.00	0.629
70.20	0.660
74.60	0.666
80.80	0.711
91.10	0.763

CURVE 23

T	k
2.514	0.0146
3.651	0.0216
4.245	0.0250
7.47	0.0458
10.32	0.0664
14.96	0.1007
20.24	0.1366
27.27	0.1828
35.38	0.240
60.26	0.368
67.89	0.398
78.38	0.445
90.6	0.500

CURVE 24

T	k
2.147	0.0169
2.721	0.0219
3.081	0.0260
3.188	0.0262
3.745	0.0334
3.781	0.0335
4.24	0.0386
4.25	0.0388
8.19	0.1004
12.46	0.1616
18.34	0.244
24.16	0.298
33.24	0.358
60.43	0.480
72.12	0.530
90.60	0.615

CURVE 25

T	k
302.2	1.046
307.1	1.067
315.8	1.092
316.3	1.084
319.3	1.100
324.8	1.100
334.6	1.121

CURVE 26

T	k
313.8	1.146
317.9	1.134
321.5	1.163
324.2	1.142
325.9	1.155
331.9	1.180
332.1	1.159
335.3	1.176
337.8	1.172
343.5	1.192

CURVE 27

T	k
1.92	0.0858
2.41	0.1089
2.81	0.1287
3.28	0.1518
3.66	0.171
4.27	0.200
6.07	0.3109
7.04	0.368
9.27	0.5205
12.10	0.679
16.15	0.919
20.84	1.183
23.9	1.449
31.3	1.76
37.2	1.88
40.9	1.99
46.3	2.07
55.4	2.17
71.7	2.30
77.4	2.37
90.9	2.50
91.0	2.48
103.3	2.62
121.4	2.82

CURVE 28

T	k
1.99	0.0426
2.28	0.0497
2.68	0.0583
3.12	0.0702
3.67	0.0834
4.25	0.1007

CURVE 28 (cont.)

T	k
6.53	0.1713
8.66	0.2426
11.24	0.326
15.59	0.483
23.01	0.718
31.07	0.919
42.4	1.128
55.5	1.236
61.6	1.335
67.5	1.402
80.5	1.458
90.8	1.570

CURVE 29

T	k
2.17	0.0303
2.87	0.0416
3.56	0.0528
4.25	0.0653
6.60	0.115
8.71	0.165
11.12	0.232
15.78	0.337
21.99	0.471
30.28	0.649
44.7	0.766
55.1	0.846
64.8	0.922
71.1	0.946
79.5	1.009
90.7	1.084

CURVE 30

T	k
2.0	0.0109
2.41	0.0131
2.75	0.0149
3.25	0.0175
3.75	0.0203
4.25	0.0231
6.33	0.0358
8.45	0.0476
12.78	0.0753
17.42	0.107
26.57	0.163
34.13	0.207
41.15	0.244

CURVE 30 (cont.)

T	k
56.9	0.318
61.9	0.346
62.7	0.345
64.9	0.354
68.7	0.366
70.2	0.376
72.8	0.390
74.4	0.398
79.4	0.422
80.0	0.423
90.8	0.466
91.4	0.473

CURVE 31

T	k
6.54	0.0407
8.58	0.0536
12.69	0.0824
16.53	0.1118
26.50	0.179
36.66	0.248
44.32	0.290
55.08	0.344
63.28	0.384
70.2	0.414
80.2	0.458
81.0	0.456
90.8	0.502
90.8	0.509

CURVE 32

T	k
2.08	0.0133
2.37	0.0151
2.78	0.0180
3.21	0.0206
3.70	0.0241
4.21	0.0277
6.74	0.0461
9.08	0.0651
13.33	0.101
17.23	0.136
23.85	0.192
33.15	0.265
41.5	0.310
54.9	0.370

CURVE 32 (cont.)

T	k
63.3	0.415
72.18	0.453
81.2	0.494
90.8	0.542

CURVE 33

T	k
1.98	0.01405
2.27	0.0162
2.77	0.0202
3.25	0.0244
3.72	0.0283
4.26	0.0334
6.17	0.0532
8.98	0.0879
12.69	0.127
16.75	0.185
27.28	0.295
35.8	0.364
44.2	0.392
54.9	0.442
63.4	0.477
72.1	0.510
80.4	0.546
90.9	0.611

CURVE 34

T	k
273.2	1.80
373.2	1.99

CURVE 35

T	k
273.2	1.34
373.2	1.49

CURVE 36

T	k
273.2	1.14
373.2	1.30

CURVE 37

T	k
273.2	1.08
373.2	1.25

CURVE 38

T	k
90	0.660
273	1.270

CURVE 39

T	k
90	0.656
273	1.295

CURVE 40*

T	k
2.3	0.00265
2.6	0.00304
2.8	0.00336
3.1	0.00375
3.3	0.00413
3.4	0.00413
3.6	0.00454
4.0	0.00508
4.2	0.00525
4.4	0.00576

CURVE 41*

T	k
2.3	0.00255
2.5	0.00285
2.75	0.00319
3.0	0.00351
3.3	0.00389
3.5	0.00415
3.8	0.00460
3.95	0.00484
4.2	0.00521
4.5	0.00567

CURVE 42*

T	k
2.4	0.00259
2.6	0.00286
2.7	0.00298
2.95	0.00327
3.2	0.00358
3.4	0.00381
3.6	0.00407
3.8	0.00433
4.0	0.00460
4.2	0.00487
4.5	0.00527

* Not shown on plot

DATA TABLE NO. 118 (continued)

T	k
CURVE 43*	
2.3	0.00240
2.5	0.00260
2.75	0.00289
3.0	0.00318
3.2	0.00342
3.5	0.00371
3.6	0.00383
3.9	0.00417
4.2	0.00454
4.4	0.00477
CURVE 44	
78.2	1.284
273.2	2.188
CURVE 45	
78.2	1.046
273.2	1.874
CURVE 46	
78.2	0.808
273.2	1.602
CURVE 47	
78.2	0.714
273.2	1.481
CURVE 48	
78.2	0.589
273.2	1.439
CURVE 49	
78.2	0.623
273.2	1.343
CURVE 50	
78.2	0.[illegible]3
273.2	1.213

T	k
CURVE 51	
78.2	0.510
273.2	1.438*
CURVE 52	
78.2	0.548
273.2	1.488
CURVE 53	
78.2	0.646
273.2	1.276*
CURVE 54	
78.2	0.887
273.2	1.411
CURVE 55	
78.2	1.469
273.2	1.607
CURVE 56	
1.37	0.0366
1.76	0.0475
2.00	0.0551
2.31	0.0635
2.79	0.0770
3.00	0.0831
3.38	0.0941
3.75	0.105
3.88	0.110
4.00	0.115
CURVE 57	
1.4	0.0160
1.8	0.0208
2.0	0.0235
2.3	0.0280
2.68	0.0338
3.0	0.0385
3.3	0.0430

T	k
CURVE 57 (cont.)	
3.7	0.0500
4.0	0.0560
CURVE 58	
1.4	0.0145
1.8	0.0184
2.0	0.0210
2.3	0.0250
2.68	0.0298
3.0	0.0340
3.3	0.0385
3.7	0.0440
4.0	0.0483
CURVE 59	
1.37	0.0094
1.76	0.0126
2.00	0.0150
2.31	0.0179
2.79	0.0220
3.00	0.0241
3.38	0.0282
3.75	0.0325
3.88	0.0340
4.00	0.0360

* Not shown on plot

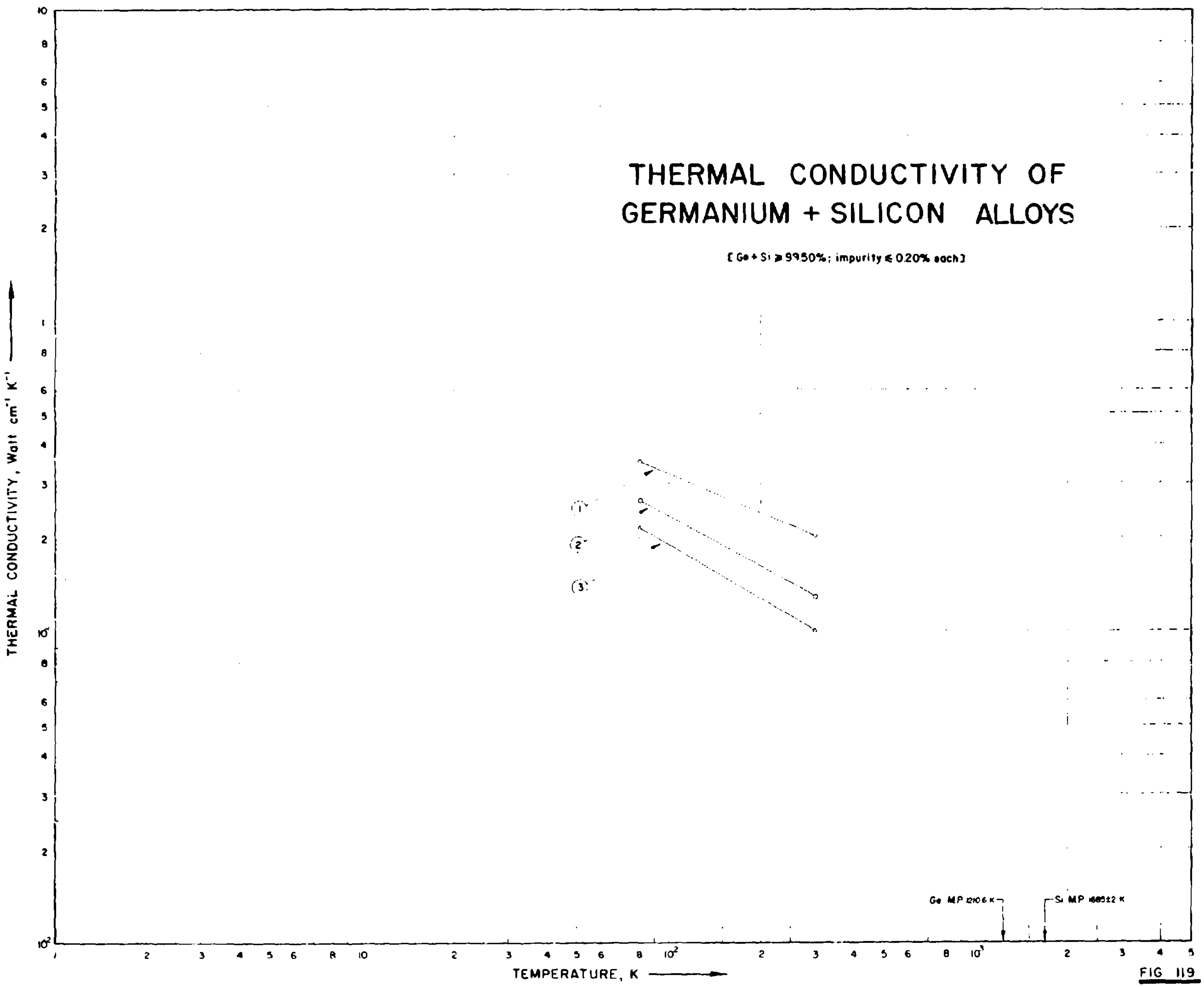

THERMAL CONDUCTIVITY OF
GERMANIUM + SILICON ALLOYS
[Ge + Si ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ge MP 1210.6 K
Si MP 1685±2 K
1
2
3

FIG 119

SPECIFICATION TABLE NO. 119 THERMAL CONDUCTIVITY OF GERMANIUM - SILICON ALLOYS

(Ge + Si ≥ 99.50%, impurity ≤ 0.20% each)

For Data Reported in Figure and Table No. 119

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ge	Si	Composition (continued), Specifications and Remarks
1	263	L	1958	80-300			95.11	4.56	p-type; calculated composition; In doped; lattice constant [illegible]; specimen 5x5x15 mm; grown by zone leveling technique; grain size ~1 cm dia; measured in a vacuum of 10 [illegible] mm Hg.
2	263	L	1958	80-300			82.76	17.24	Similar to the above specimen except lattice constant 5.568.
3	263	L	1958	80-300			67.00	33.00	Similar to the above specimen except lattice constant 5.527.

DATA TABLE NO. 119 THERMAL CONDUCTIVITY OF [GERMANIUM + SILICON] ALLOYS

(Ge + Si ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
80	0.350
300	0.201
CURVE 2	
80	0.264
300	0.128
CURVE 3	
80	0.214
300	0.100

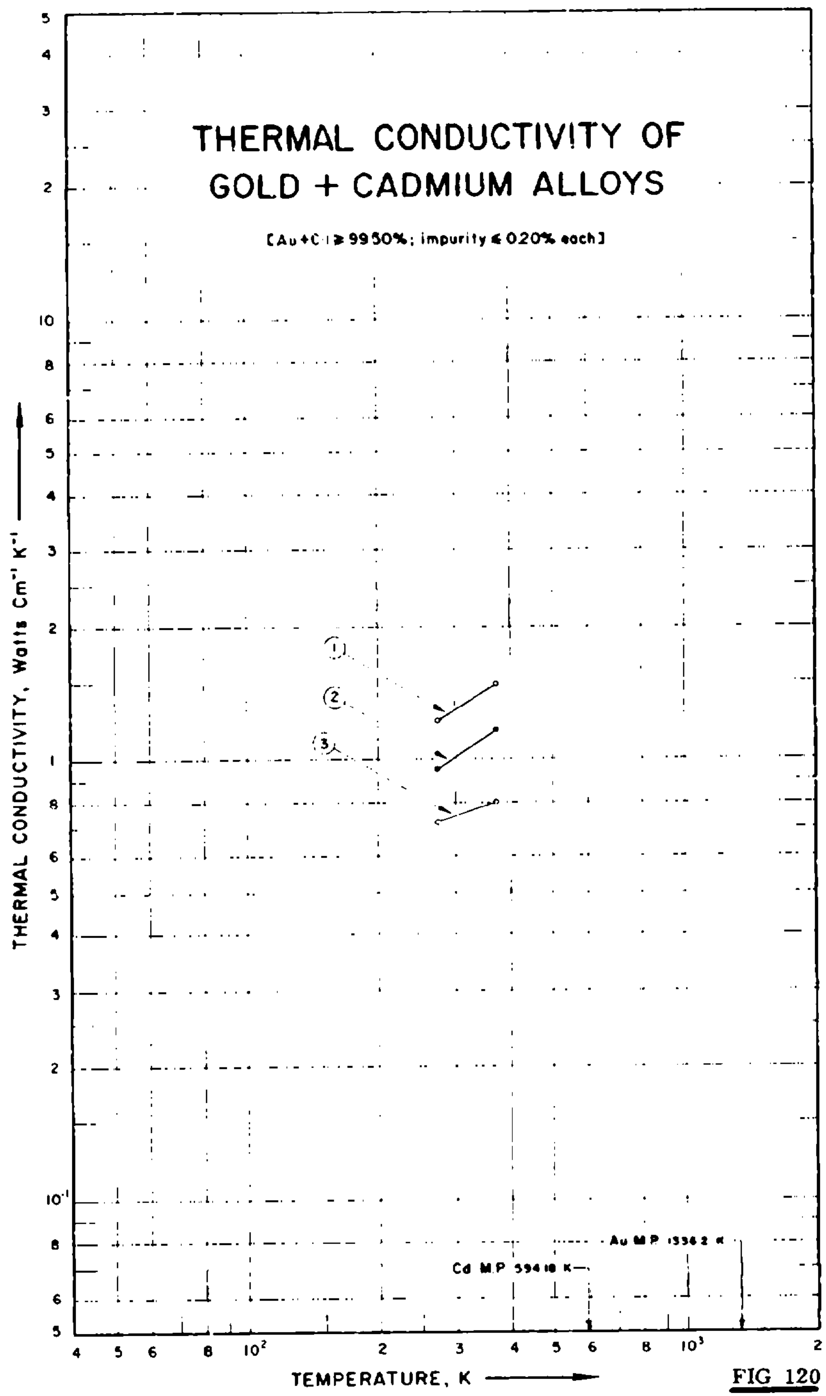

THERMAL CONDUCTIVITY OF
GOLD + CADMIUM ALLOYS
[Au+Cd ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Au M.P. 1336.2 K
Cd M.P. 594.18 K
1
2
3

FIG 120

SPECIFICATION TABLE NO. 120 THERMAL CONDUCTIVITY OF [GOLD + CADMIUM] ALLOYS

(Au + Cd ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 120]

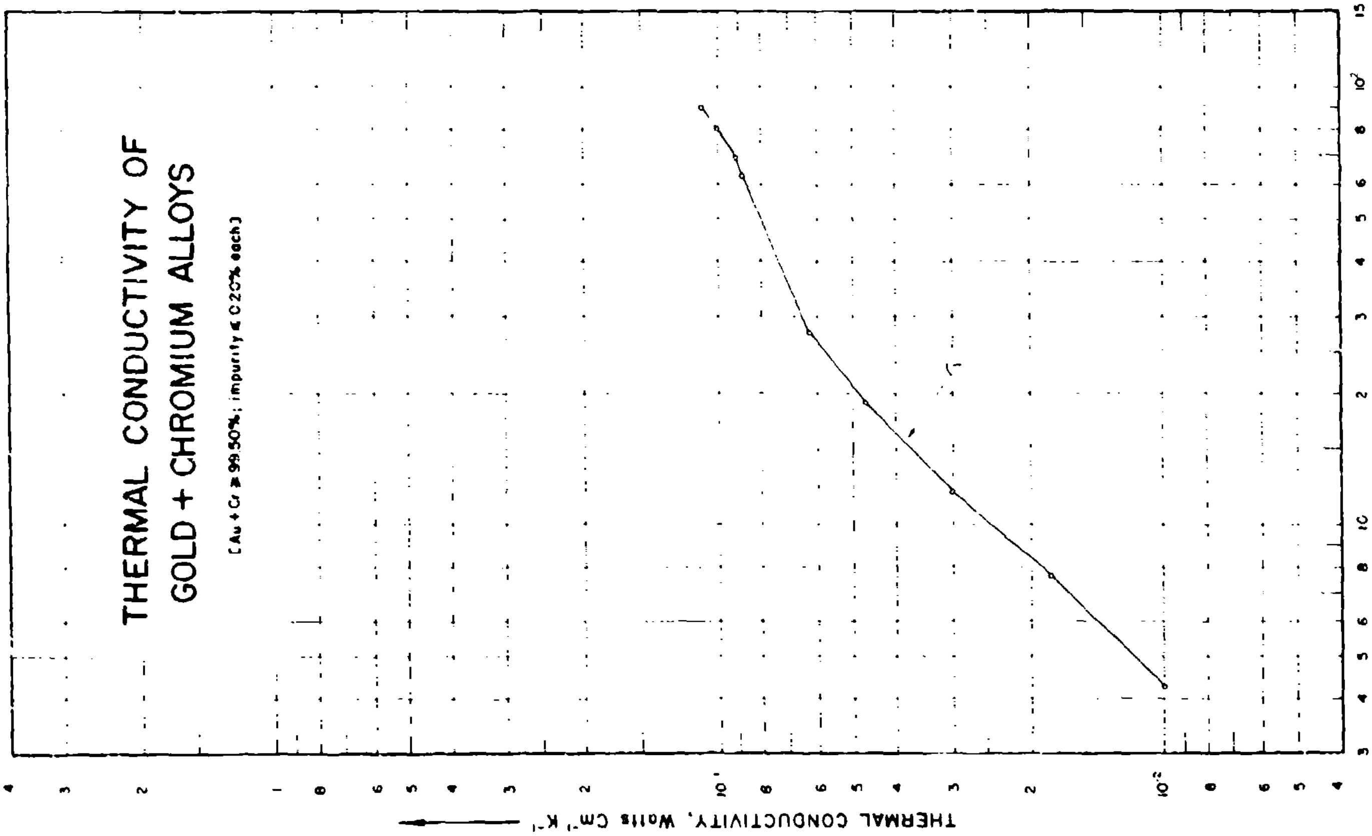
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Cd	Composition (continued), Specifications and Remarks
1	246	T	1919	273, 373			96.85	3.15	Calculated composition, rolled and drawn to 1 mm dia wire annealed close to melting point for 0.5 hr; electrical conductivity 17.4 and 16.8 x 10^4 $ohm^{-1} cm^{-1}$ at 0 and 100 C, respectively.
2	246	T	1919	273, 373			94.85	5.15	Similar to the above specimen except electrical conductivity 12.9 and 12.[illegible] x 10^4 $ohm^{-1} cm^{-1}$ at 0 and 100 C, respectively.
3	246	T	1919	273, 373			89.41	10.59	Similar to the above specimen except electrical conductivity 8.9 and 8.2 x 10^4 $ohm^{-1} cm^{-1}$ at 0 and 100 C, respectively.

DATA TABLE NO. 120 THERMAL CONDUCTIVITY OF [GOLD + CADMIUM] ALLOYS

(Au + Cd > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
273.2	1.23
373.2	1.48
CURVE 2	
273.2	0.95
373.2	1.17
CURVE 3	
273.2	0.72
373.2	0.90



THERMAL CONDUCTIVITY OF
GOLD + CHROMIUM ALLOYS
[Au + Cr ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 121

SPECIFICATION TABLE NO. 121 THERMAL CONDUCTIVITY OF [GOLD + CHROMIUM] ALLOYS

(Au + Cr ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 121]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Cr	Composition (continued), Specifications and Remarks
1	450	L	1959	4.3-90			98.29	1.71	Calculated composition; 2 mm dia; drawn, annealed in He at 500 C for 12 hrs; ρ_0 = 27.9 μohm cm.

DATA TABLE NO. 121 THERMAL CONDUCTIVITY OF [GOLD + CHROMIUM] ALLOYS

(Au + Cr ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
4.3	0.01
7.7	0.018
12.0	0.03
19.2	0.047
27.6	0.063
63.2	0.089
69.6	0.092
80.4	0.101
90.2	0.109

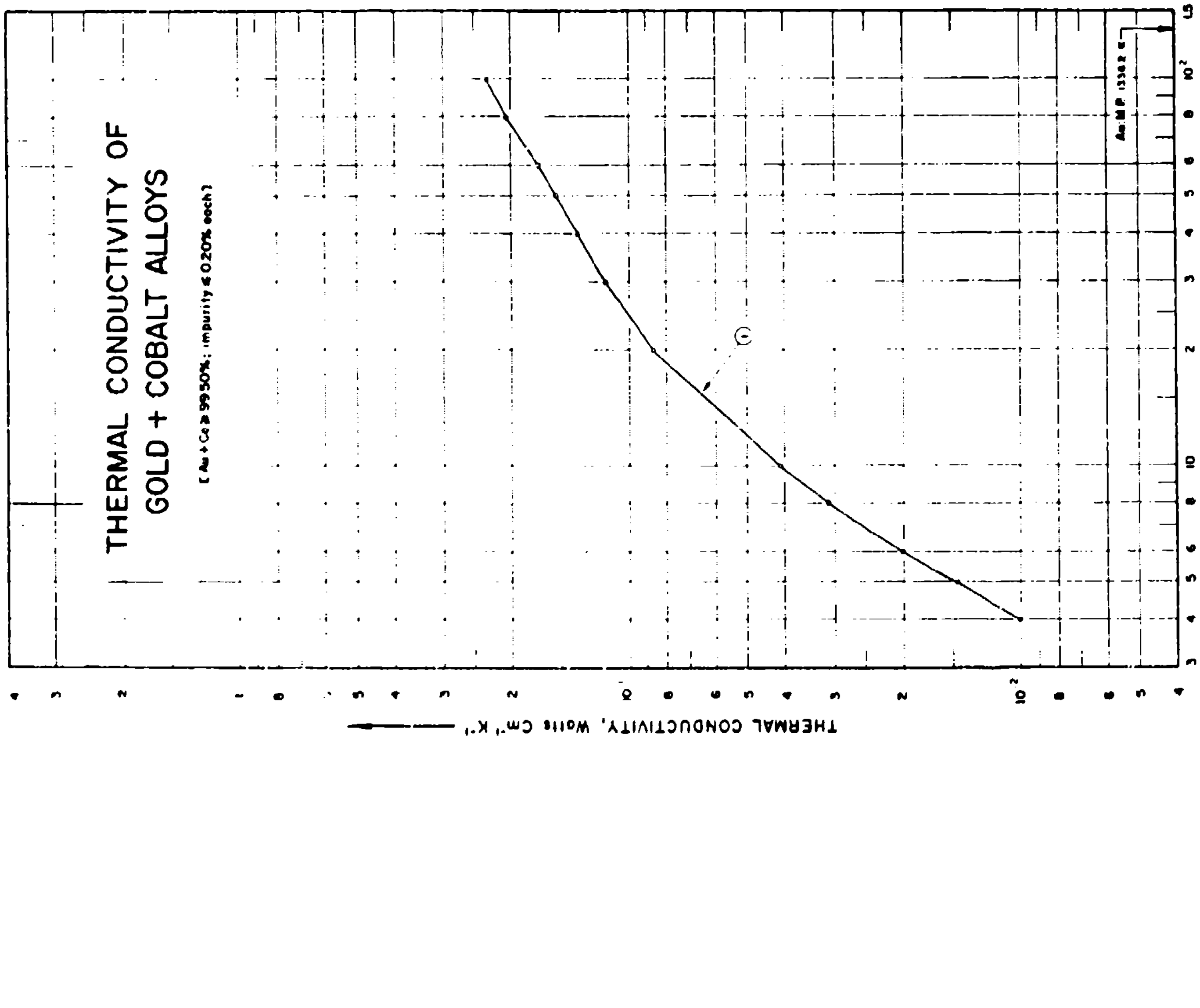

THERMAL CONDUCTIVITY OF
GOLD + COBALT ALLOYS
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
1

FIG 122

SPECIFICATION TABLE NO. 122 THERMAL CONDUCTIVITY OF (GOLD + COBALT) ALLOYS

(Au + Co ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 122]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Co	Composition (continued), Specifications and Remarks
1	573		1960	4-100			99.361	0.639	Calculated composition; hard drawn; supplied by Sigmund Cohn Corp.; electrical resistivity 1.20 x 10^{-5} ohm cm at 30 K.

DATA TABLE NO. 122 THERMAL CONDUCTIVITY OF [GOLD + COBALT] ALLOYS

(Au + Co ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
4.0	0.01
5.0	0.0146
6.0	0.020
8.0	0.031
10.0	0.041
20.0	0.086
30.0	0.115
40.0	0.135
50.0	0.154
60.0	0.171
80.0	0.205
100.0	0.23

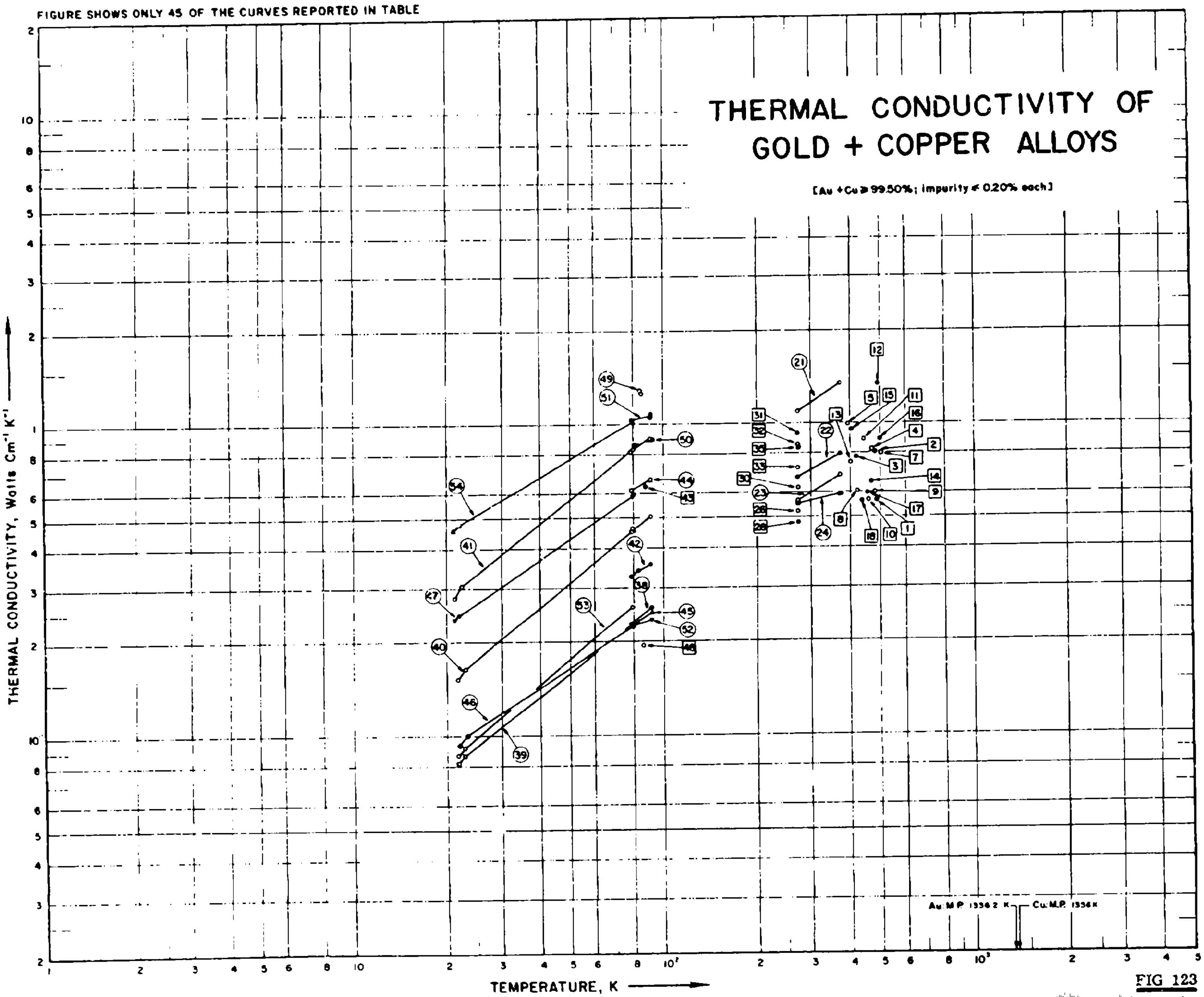


FIGURE SHOWS ONLY 45 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
GOLD + COPPER ALLOYS
[Au + Cu ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Au: M.P. 1336.2 K
Cu: M.P. 1356 K

FIG 123

SPECIFICATION TABLE NO. 123 THERMAL CONDUCTIVITY OF [GOLD + COPPER] ALLOYS

(Au + Cu ≥ 99.50%; impurity ≤ 0.20%)

[For Data Reported in Figure and Table No. 123]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Cu	Composition (continued), Specifications and Remarks
1	232	L	1957	488.7		IV	75.61	24.39	Calculated composition; cast; specimen 1.30 cm long, 0.63 cm^2 cross sectional area; density 18.34 g cm^{-3}.
2	232	L	1957	483.2		IV			The above specimen annealed 10 hrs at 200 C.
3	232	L	1957	420.7		IV			The above specimen annealed 20 hrs at 200 C.
4	232	L	1957	473.7		IV			The above specimen annealed 30 hrs at 200 C.
5	232	L	1957	395.2		IV			The above specimen annealed 40 hrs at 200 C.
6	232	L	1957	466.2		V	85.20	14.80	Calculated composition; cast; specimen 1.30 cm long, 0.63 cm^2 cross sectional area; density 19.40 g cm^{-3}.
7	232	L	1957	504.7		V			The above specimen annealed 10 hrs at 200 C.
8	232	L	1957	426.2		V			The above specimen annealed 20 hrs at 200 C.
9	232	L	1957	481.7		V			The above specimen annealed 30 hrs at 200 C.
10	232	L	1957	460.7		V			The above specimen annealed 40 hrs at 200 C.
11	232	L	1957	445.7		II	50.82	49.18	Calculated composition; cast; specimen 1.49 cm long, 0.63 cm^2 cross sectional area; density 15.05 g cm^{-3}.
12	232	L	1957	480.2		II			The above specimen annealed 10 hrs at 200 C.
13	232	L	1957	401.7		II			The above specimen annealed 20 hrs at 200 C.
14	232	L	1957	470.2		II			The above specimen annealed 30 hrs at 200 C.
15	232	L	1957	403.7		II			The above specimen annealed 40 hrs at 200 C.
16	232	L	1957	497.7		III	62.54	37.46	Calculated composition; cast; specimen 1.45 cm long, 0.63 cm^2 cross sectional area; density 16.70 g cm^{-3}.
17	232	L	1957	455.7		III			The above specimen annealed 10 hrs at 200 C.
18	232	L	1957	437.7		III			The above specimen annealed 20 hrs at 200 C.
19	232	L	1957	457.7		III			The above specimen annealed 30 hrs at 200 C.
20	232	L	1957	444.7		III			The above specimen annealed 40 hrs at 200 C.
21	246	T	1919	273, 373			96.73	3.27	Calculated composition; rolled and drawn to 1 mm dia wire; annealed close to melting point for 0.5 hr; electrical conductivity 14.3 and 13.4 x 10^4 ohm^{-1} cm^{-1} at 0 and 100 C respectively.
22	246	T	1919	273, 373			92.55	7.45	Similar to the above specimen except electrical conductivity 9.5 and 8.2 x 10^4 ohm^{-1} cm^{-1} at 0 and 100 C respectively.

SPECIFICATION TABLE NO. 123 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Cu	Composition (continued), Specifications and Remarks
23	246	T	1919	273,373			87.77	12.23	Similar to the above specimen except electrical conductivity 6.3 and 5.9 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.
24	246	T	1919	273,373			59.25	40.75	Similar to the above specimen except electrical conductivity 5.0 and 4.6 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.
25	430	T	1924	273.2			50.8	49.2	Specimen rolled and drawn to 1 mm^2 cross sectional area; 3 cm long; annealed close to melting point for 0.5 hr; electrical resistivity at 273 K, $\rho(273)$ = 10.8 μohm cm.
26	430	T	1924	273.2			54.0	46.0	Similar to the above specimen except $\rho(273)$ = 11.4 μohm cm.
27	430	T	1924	273.2			57.0	43.0	Similar to the above specimen except $\rho(273)$ = 11.8 μohm cm.
28	430	T	1924	273.2			62.6	37.4	Similar to the above specimen except $\rho(273)$ = 13.0 μohm cm.
29	430	T	1924	273.2			67.2	32.8	Similar to the above specimen except $\rho(273)$ = 13.6 μohm cm.
30	430	T	1924	273.2			71.9	28.1	Similar to the above specimen except $\rho(273)$ = 10.5 μohm cm.
31	430	T	1924	273.2			78.1	21.9	Similar to the above specimen except $\rho(273)$ = 7.6 μohm cm.
32	430	T	1924	273.2			78.2	21.8	Similar to the above specimen except $\rho(273)$ = 7.6 μohm cm.
33	430	T	1924	273.2			78.9	21.1	Similar to the above specimen except $\rho(273)$ = 8.4 μohm cm.
34	430	T	1924	273.2			82.1	17.9	Similar to the above specimen except $\rho(273)$ = 11.6 μohm cm.
35	430	T	1924	273.2			82.4	17.6	Similar to the above specimen except $\rho(273)$ = 11.6 μohm cm.
36	430	T	1924	273.2			87.5	12.5	Similar to the above specimen except $\rho(273)$ = 11.6 μohm cm.
37	430	T	1924	273.2			94.1	5.9	Similar to the above specimen except $\rho(273)$ = 8.0 μohm cm.
38	58	L	1934	80,92		11	89.6	10.4	Polycrystalline specimen; cast; electrical resistivity at 83 K, $\rho(83)$ = 927 μohm cm.
39	58	L	1934	22-80		11a	89.6	10.4	The above specimen annealed 40 hrs at 365 C in vacuo; $\rho(83)$ = 927 μohm cm.
40	58	L	1934	22-91		12	96.9	3.10	Polycrystalline specimen; cast; $\rho(83)$ = 434.5 μohm cm.
41	58	L	1934	21-91		13	98.43	1.57	Polycrystalline specimen; cast; $\rho(83)$ = 435.3 μohm cm.
42	58	L	1934	79-91		14a	50.1	49.9	Polycrystalline specimen; cast; quenched from 800 C; $\rho(83)$ = 664 μohm cm.
43	58	L	1934	87.4		14b	50.1	49.1	The above specimen annealed at ~400 C for 20 hrs; $\rho(83)$ = 323 μohm cm.
44	58	L	1934	79,92		14c	50.1	49.1	The above specimen annealed at ~360 C for 32 hrs; $\rho(83)$ = 312.6 μohm cm.

SPECIFICATION TABLE NO. 123 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Cu	Composition (continued), Specifications and Remarks
45	58	L	1934	80, 92		14d	50.1	49.1	The above specimen annealed at ~820 C for 2 hrs then quenched.
46	58	L	1934	22-89		14e	50.1	49.1	The above specimen measured after 5 months; $\rho(83)$ = 988 μohm cm.
47	58	L	1934	21-81		14f	50.1	49.1	The above specimen annealed at ~325 C for 30 hrs; $\rho(83)$ = 341 μohm cm.
48	58	L	1934	86.9		15a	75.6	24.4	Polycrystalline specimen, cast; quenched from 800 C; $\rho(83)$ = 1157 μohm cm.
49	58	L	1934	85, 85		15b	75.6	24.4	The above specimen annealed at 360 C for 22 hrs; $\rho(83)$ = 175.3 μohm cm.
50	58	L	1934	81, 92		15c	75.6	24.4	The above specimen annealed at 345 C for 30 hrs; $\rho(83)$ = 222.8 μohm cm.
51	58	L	1934	79-91		15d	75.6	24.4	The above specimen annealed at 325 C for 30 hrs; $\rho(83)$ = 179.7 μohm cm.
52	58	L	1934	79, 91		15e	75.6	24.4	The above specimen annealed at 800 C for 2 hrs; quenched; $\rho(83)$ = 917.0 μohm cm.
53	58	L	1934	22-79		15f	75.6	24.4	The above specimen measured after 4 months; $\rho(83)$ = 790.0 μohm cm.
54	58	L	1934	21-80		15g	75.6	24.4	The above specimen annealed at ~325 C for 30 hrs; $\rho(83)$ = 182.6 μohm cm.

DATA TABLE NO. 123 THERMAL CONDUCTIVITY OF GOLD + COPPER ALLOYS

(Au + Cu 99.56%, impurity 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

	T	k
CURVE 1	488.7	0.561
CURVE 2	483.2	0.803
CURVE 3	420.7	0.774
CURVE 4	473.7	0.816
CURVE 5	395.2	0.987
CURVE 6*	466.2	0.812
CURVE 7	504.7	0.795
CURVE 8	426.2	0.602
CURVE 9	481.7	0.598
CURVE 10	460.7	0.565
CURVE 11	445.7	0.879
CURVE 12	493.2	1.34
CURVE 13	401.7	0.745
CURVE 14	470.2	0.649
CURVE 15	403.7	0.946
CURVE 16	497.7	0.879
CURVE 17	455.7	0.594
CURVE 18	437.7	0.561
CURVE 19	457.7	0.552
CURVE 20	444.7	0.569
CURVE 21	273.2	1.09
	373.2	1.34
CURVE 22	273.2	0.67
	373.2	0.79
CURVE 23	273.2	0.56
	373.2	0.68
CURVE 24	273.2	0.55
	373.2	0.59
CURVE 25	273.2	0.59
CURVE 26	273.2	0.52
CURVE 27*	273.2	0.48
CURVE 28	273.2	0.48
CURVE 29*	273.2	0.47
CURVE 30	273.2	0.62
CURVE 31	273.2	0.92
CURVE 32	273.2	0.85
CURVE 33	273.2	0.72
CURVE 34	273.2	0.51
CURVE 35	273.2	0.83
CURVE 36*	273.2	0.50
CURVE 37*	273.2	0.73
CURVE 38	79.6	0.228
	91.5	0.259
CURVE 39	21.7	0.0817
	22.8	0.0861
	80.0	0.229
CURVE 40	21.8	0.153
	23.0	0.165
	79.0	0.453
	79.5	0.461
	80.1	0.459
	91.3	0.505
CURVE 41	21.2	0.278
	22.4	0.305
	78.8	0.814
	80.3	0.828
	91.4	0.893
CURVE 42	78.6	0.325
	83.2	0.339
	90.8	0.355
CURVE 43	87.4	0.629
CURVE 44	79.3	0.616
	91.7	0.662
CURVE 45	80.2	0.226
	91.6	0.248
CURVE 46	21.9	0.0936
	23.2	0.100
	80.0	0.227
CURVE 47	21.3	0.236
	22.1	0.245
	80.3	0.582
	80.7	0.591
CURVE 48	85.9	0.193
CURVE 49	84.8	1.25
	85.3	1.27
CURVE 50	80.9	0.849
	91.8	0.894
CURVE 51	79.1	1.03
	91.3	1.07
	91.4	1.08
CURVE 52	79.3	0.227
	91.4	0.235
CURVE 53	21.6	0.0861
	22.7	0.0916
	79.1	0.259
CURVE 54	21.0	0.458
	22.0	0.476
	80.4	1.01

* Not shown on plot

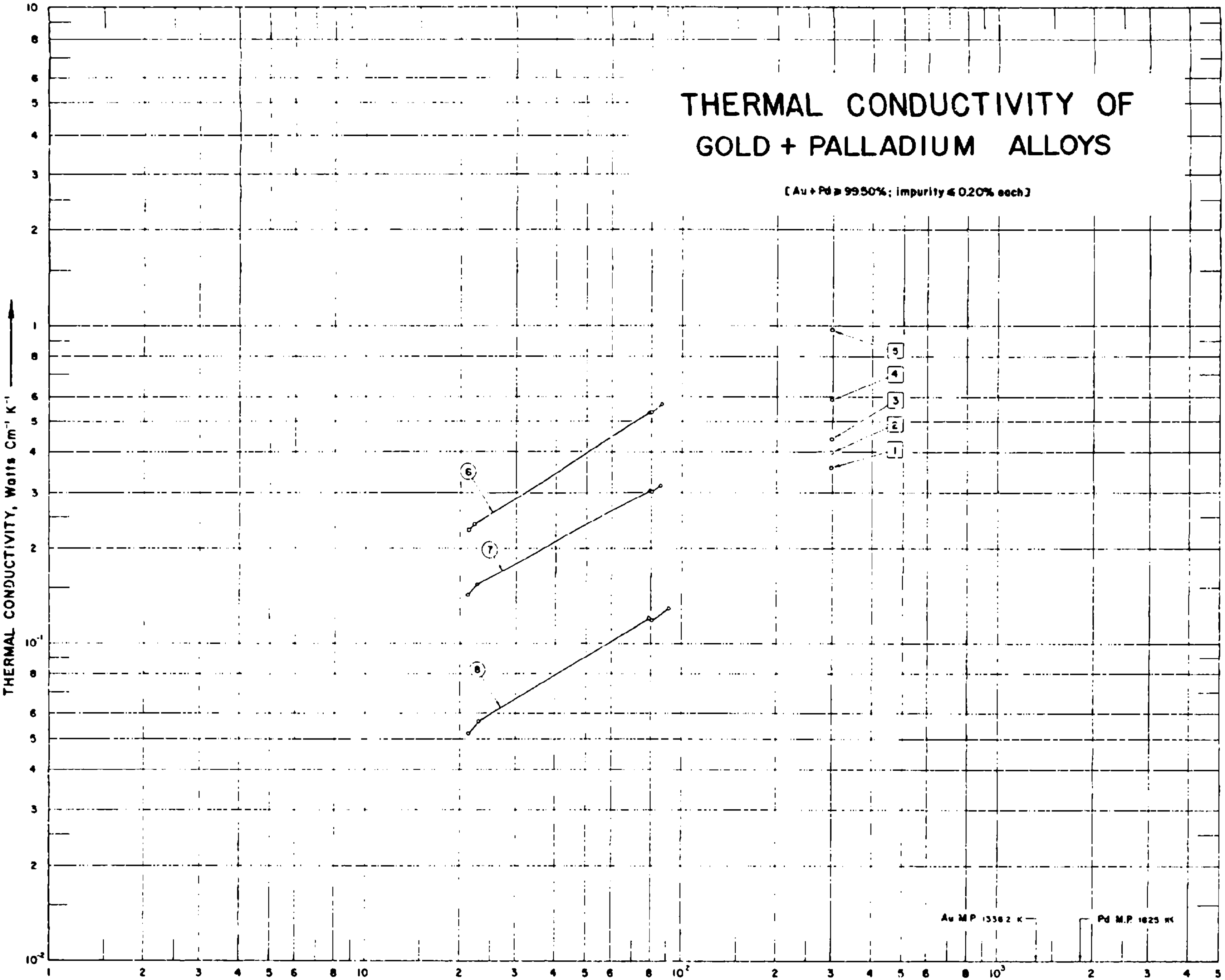

THERMAL CONDUCTIVITY OF
GOLD + PALLADIUM ALLOYS
[Au + Pd ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Au M.P. 1336.2 K
Pd M.P. 1825 K
1
2
3
4
5
6
7
8

FIG 124

SPECIFICATION TABLE NO. 124 THERMAL CONDUCTIVITY OF [GOLD + PALLADIUM] ALLOYS

(Au + Pd ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 124]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Pd	Composition (continued), Specifications and Remarks
1	241	E	1911	298.2			50	50	Approx. composition; electrical conductivity 3.7 x 10^4 $ohm^{-1} cm^{-1}$ at 25 C.
2	241	E	1911	298.2			60	40	Approx. composition; electrical conductivity 4.02 x 10^4 $ohm^{-1} cm^{-1}$ at 25 C.
3	241	E	1911	298.2			70	30	Approx. composition; electrical conductivity 5.45 x 10^4 $ohm^{-1} cm^{-1}$ at 25 C.
4	241	E	1911	298.2			80	20	Approx. composition; electrical conductivity 7.82 x 10^4 $ohm^{-1} cm^{-1}$ at 25 C.
5	241	E	1911	298.2			90	10	Approx. composition; electrical conductivity 13.27 x 10^4 $ohm^{-1} cm^{-1}$ at 25 C.
6	58	L	1934	21-87		22	95	5	Calculated composition; heated at 800 C for 2 hrs; 5.44, ~~μohm cm~~ electrical resistivity, 3.939, and 3.479 μohm cm at ~~[illegible]~~ 0-190, and -251 C, respectively.
7	58	L	1934	21-96		23	90	10	Calculated composition; heated at 800 C for 2 hrs; 9.10, ~~μohm cm~~ electrical resistivity, 7.605, and 7.175 μohm cm at ~~[illegible]~~ 9-190, and -251 C, respectively.
8	58	L	1934	21-92		24	60.1	39.9	Calculated composition; heated at 800 C for 2 hrs; 27.1, ~~μohm cm~~ electrical resistivity, 24.48, and 23.66 μohm cm at ~~[illegible]~~ 9-190, and -251 C, respectively.

DATA TABLE NO. 121 THERMAL CONDUCTIVITY OF GOLD + PALLADIUM ALLOYS

(Au + Pd 99.80%; impurity 0.20% each)

Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}

T	k
CURVE 1	
298.2	0.360
CURVE 2	
298.2	0.400
CURVE 3	
298.2	0.440
CURVE 4	
298.2	0.590
CURVE 5	
298.2	0.980
CURVE 6	
21.3	0.227
22.2	0.23[illegible]
79.8	0.538
80.3	0.53[illegible]
86.5	0.571
CURVE 7	
21.2	0.142
22.6	0.153
79.6	0.505
80.5	0.504
86.0	0.517
CURVE 8	
21.3	0.0529
23.0	0.0569
79.5	0.120
80.8	0.118
91.5	0.123

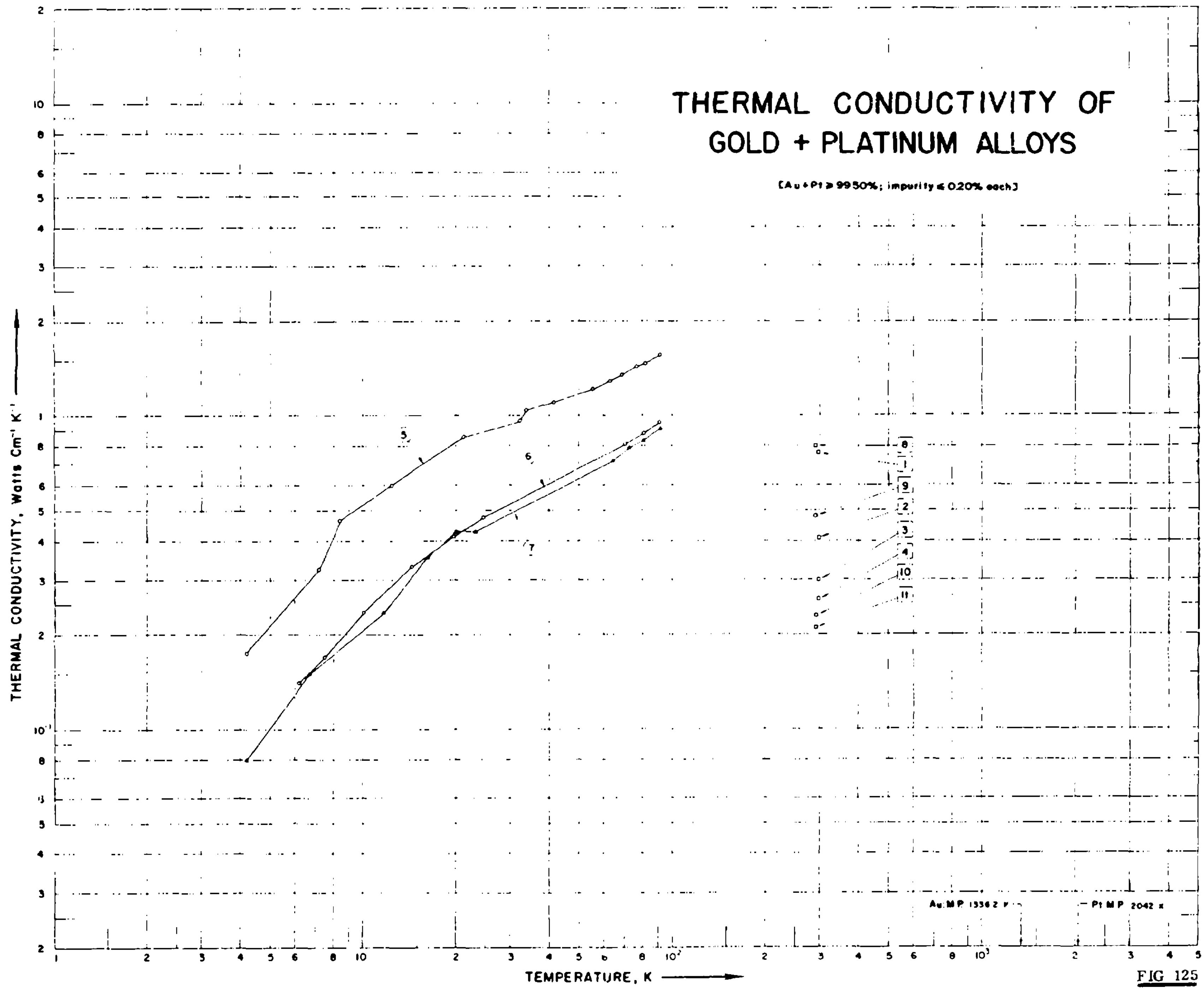

THERMAL CONDUCTIVITY OF
GOLD + PLATINUM ALLOYS
[Au + Pt ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Au M.P. 1336.2 K
Pt M.P. 2042 K
5
6
7
8
1
9
2
3
4
10
11

FIG 125

SPECIFICATION TABLE NO. 125 THERMAL CONDUCTIVITY OF [GOLD + PLATINUM] ALLOYS

(Au + Pt ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 125]

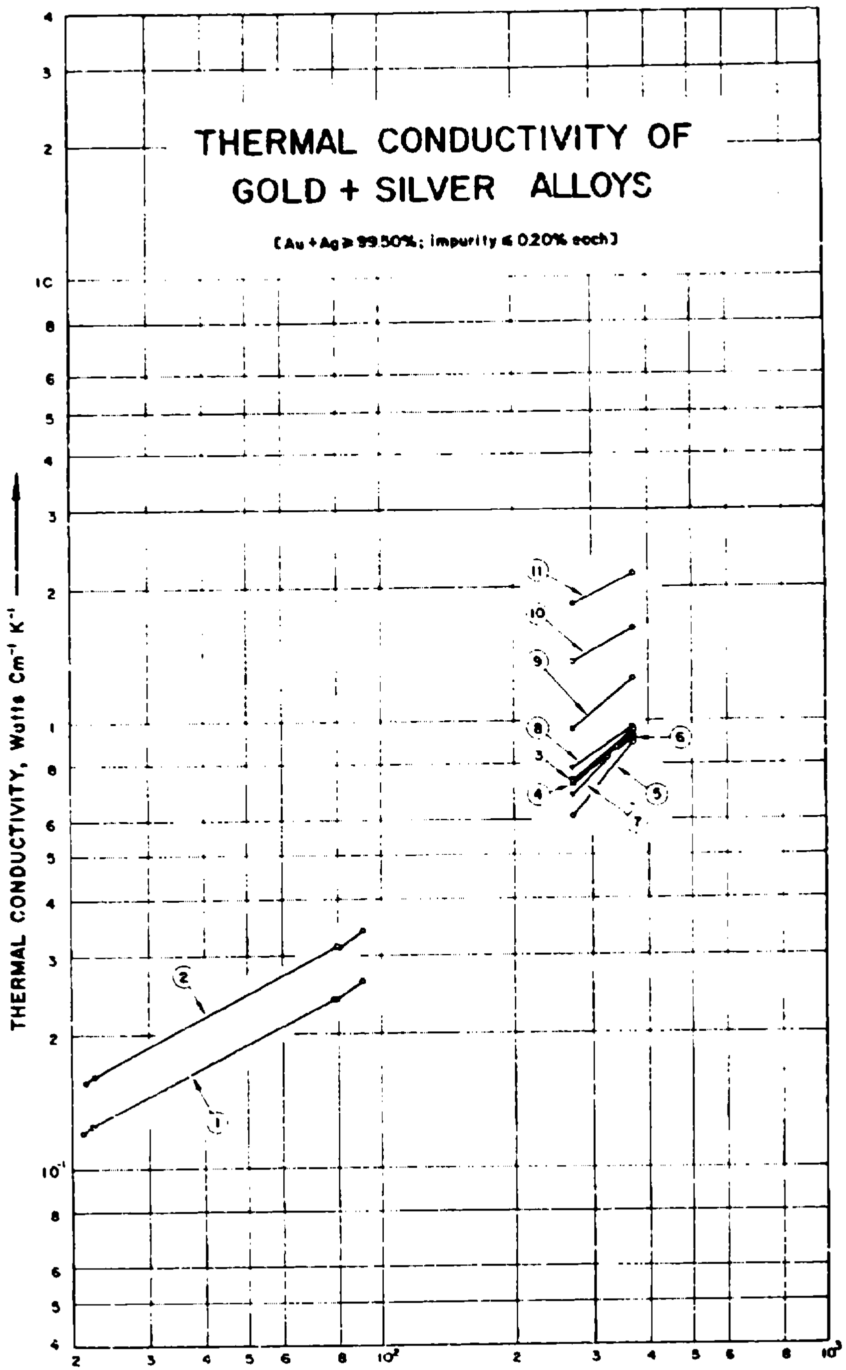
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Pt	Composition (continued), Specifications and Remarks
1	241	E	1911	298.2			90	10	Approx. composition; electrical conductivity 9.61×10^4 ohm^{-1} cm^{-1} at 25 C.
2	241	E	1911	298.2			80	20	Approx. composition; electrical conductivity 5.49×10^4 ohm^{-1} cm^{-1} at 25 C.
3	241	E	1911	298.2			70	30	Approx. composition; electrical conductivity 5.10×10^4 ohm^{-1} cm^{-1} at 25 C.
4	241	E	1911	298.2			60	40	Approx. composition; electrical conductivity 3.03×10^4 ohm^{-1} cm^{-1} at 25 C.
5	450	L	1959	4.2-92			99.3	0.7	Specimen 2.6 mm in dia; homogenized at 1050 C then drawn (reducing the cross section by 90%) and then annealed in vacuum for 4 hrs at 1050 C; ρ_0 = 0.82 μohm cm.
6	450	L	1959	6.2-91			98.2	1.8	Specimen 3 mm in dia; received as drawn; annealed in vacuum at 1082 C for 4 hrs; ρ_0 = 1.95 μohm cm.
7	450	L	1959	4.2-31			98.4	1.6	Specimen 3 mm dia; received as drawn; annealed in vacuum at 1050 C for 4 hrs; ρ_0 = 2.04 μohm cm.
8	451	T	1930	291.2			92.07	7.93	Specimen 0.79 cm in dia and 25 mm long; supplied by Heraeus, W. C.; rolled and drawn from a piece that had been tempered at 800 C and quenched.
9	451	T	1930	291.2			84.13	15.87	Similar to the above specimen.
10	451	T	1930	291.2			68.22	31.78	Similar to the above specimen.
11	451	T	1930	291.2			55.25	44.75	Similar to the above specimen.

DATA TABLE NO. 125 THERMAL CONDUCTIVITY OF [GOLD + PLATINUM] ALLOYS

(Au + Pt ≥ 99.50%; Impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		**CURVE 7**	
298	0.7[illegible]0	4.2	0.080
		6.7	0.150
CURVE 2		11.7	0.235
		16.2	0.355
298	0.410	19.[illegible]	0.43
		23.1	0.43
CURVE 3		64.2	0.715
		72.7	0.79
296	0.300	80.8	0.835
		91.2	0.91
CURVE 4			
		CURVE 8	
298	0.260		
		291.2	0.80
CURVE 5			
		CURVE 9	
4.2	0.175		
7.2	0.325	291.2	0.48
8.4	0.465		
12.3	0.600	**CURVE 10**	
21.2	0.855		
32.2	0.960	291.2	0.23
33.7	1.04		
41.5	1.10	**CURVE 11**	
55.5	1.21		
63.0	1.28	291.2	0.21
69.0	1.35		
76.4	1.43		
81.3	1.46		
91.5	1.56		
CURVE 6			
6.2	0.14		
7.5	0.17		
10.0	0.235		
14.4	0.33		
19.7	0.415		
24.5	0.475		
70.5	0.81		
80.8	0.88		
91.0	0.95		



THERMAL CONDUCTIVITY OF
GOLD + SILVER ALLOYS
[Au + Ag ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
4
5
6
7
8
9
10
11

FIG 126

SPECIFICATION TABLE NO. 126 THERMAL CONDUCTIVITY OF (GOLD + SILVER) ALLOYS

(Au + Ag ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 126]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Ag	Composition (continued), Specifications and Remarks
1	58	L	1934	21-91		6	64.6	35.4	Calculated composition; single crystal; ~~ρ = 10.8 μohm cm~~ electrical resistivity 0.32 and 8.85 μohm cm at ~~[illegible]~~ and -251 C, respectively. 10.8, 0, -190,
2	58	L	1934	22-92		7	84.5	15.5	Calculated composition, single crystal; ~~ρ = 8.69 μohm cm~~ electrical resistivity 7.16 and 6.69 μohm cm at ~~[illegible]~~ and -251 C, respectively. 8.69, 0, -190,
3	246	T	1919	273,373			54.62	45.38	Calculated composition; specimen rolled and drawn to 1 mm thick; heated 0.5 hr at temp near the melting point; electrical conductivity 9.1 and 8.4 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
4	246	T	1919	273,373			60.32	39.68	Similar to the above specimen except electrical conductivity 9.1 and 8.5 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
5	246	T	1919	273,373			65.46	34.54	Similar to the above specimen except electrical conductivity 7.2 and 7.2 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
6	246	T	1919	273,373			69.17	30.83	Similar to the above specimen except electrical conductivity 8.9 and 8.4 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
7	246	T	1919	273,373			73.19	26.81	Similar to the above specimen except electrical conductivity 9.1 and 8.5 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
8	246	T	1919	273,373			81.23	18.77	Similar to the above specimen except electrical conductivity 10.2 and 9.6 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
9	246	T	1919	273,373			88.82	11.18	Similar to the above specimen except electrical conductivity 13.2 and 12.4 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
10	246	T	1919	273,373			93.84	6.16	Similar to the above specimen except electrical conductivity 18.1 and 15.9 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
11	246	T	1919	273,373			97.26	2.74	Similar to the above specimen except electrical conductivity 25.1 and 22.0 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.

DATA TABLE NO. 126 THERMAL CONDUCTIVITY OF [GOLD + SILVER] ALLOYS

(Au + Ag $\geq$ 99.50%; impurity $\leq$ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		CURVE 9	
21.4	0.120	273.2	0.96
22.5	0.125	373.2	1.25
79.0	0.238	CURVE 10	
79.6	0.238	273.2	1.36
91.2	0.262	373.2	1.61
CURVE 2		CURVE 11	
21.7	0.156	273.2	1.84
22.7	0.162	373.2	2.14
80.0	0.314		
81.0	0.312		
91.6	0.335		
CURVE 3			
273.2	0.73		
373.2	0.95		
CURVE 4			
273.2	0.72		
373.2	0.93		
CURVE 5			
273.2	0.61		
373.2	0.89		
CURVE 6			
273.2	0.73		
373.2	0.91		
CURVE 7			
273.2	0.68		
373.2	0.93		
CURVE 8			
273.2	0.78		
373.2	0.96		

SPECIFICATION TABLE NO. 127 THERMAL CONDUCTIVITY OF [GOLD + ZINC] ALLOYS

(Au + Zn ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Au	Zn	Composition (continued), Specifications and Remarks
1	246	T	1919	273,373			98.32	1.68	Calculated composition; specimen rolled and drawn to 1 mm thick; heated .50 hr at temp near the melting point; electrical conductivity 15.6 and 14.4 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C respectively.
2	246	T	1919	273,373			96.41	3.59	Similar to the above specimen except electrical conductivity 8.5 and 8.6 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.

DATA TABLE NO. 127 THERMAL CONDUCTIVITY OF [GOLD + ZINC] ALLOYS

(Au + Zn ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
273.2	1.17
373.2	1.33
CURVE 2*	
273.2	0.67
373.2	0.81

* No graphical presentation

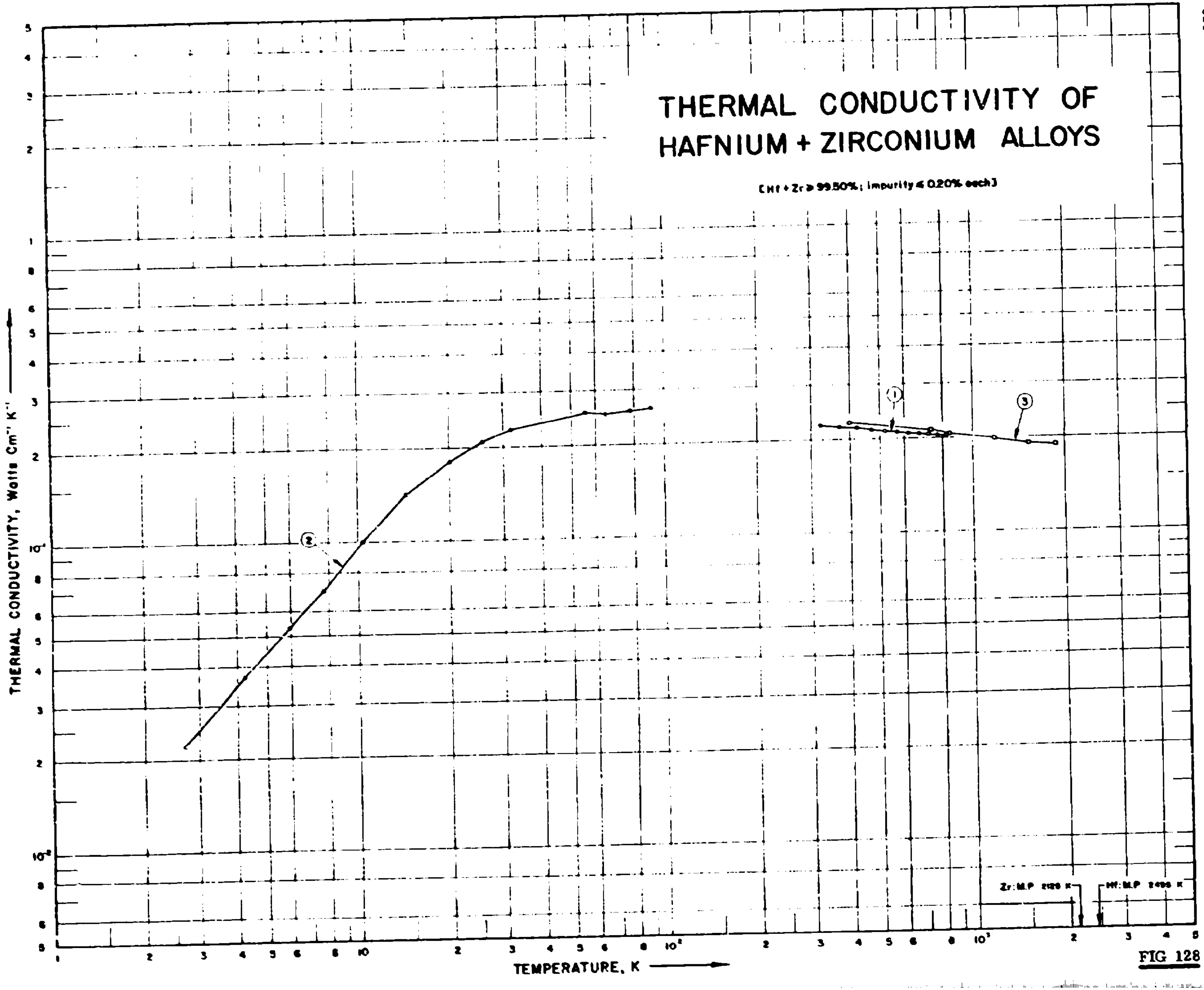

THERMAL CONDUCTIVITY OF
HAFNIUM + ZIRCONIUM ALLOYS
(Hf + Zr ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Zr: M.P
Hf: M.P
1
2
3
5
4
3
2
1
8
6
5
4
3
2
10⁻¹
8
6
5
4
3
2
10⁻²
8
6
5
1
2
3
4
5
6
8
10
2
3
4
5
6
8
10²
2
3
4
5
6
8
10³
2
3
4
5

FIG 128

SPECIFICATION TABLE NO. 128 THERMAL CONDUCTIVITY OF HAFNIUM + ZIRCONIUM ALLOYS

(Hf + Zr 99.50%; impurity 0.20% each)

[For Data Reported in Figure and Table No. 123]

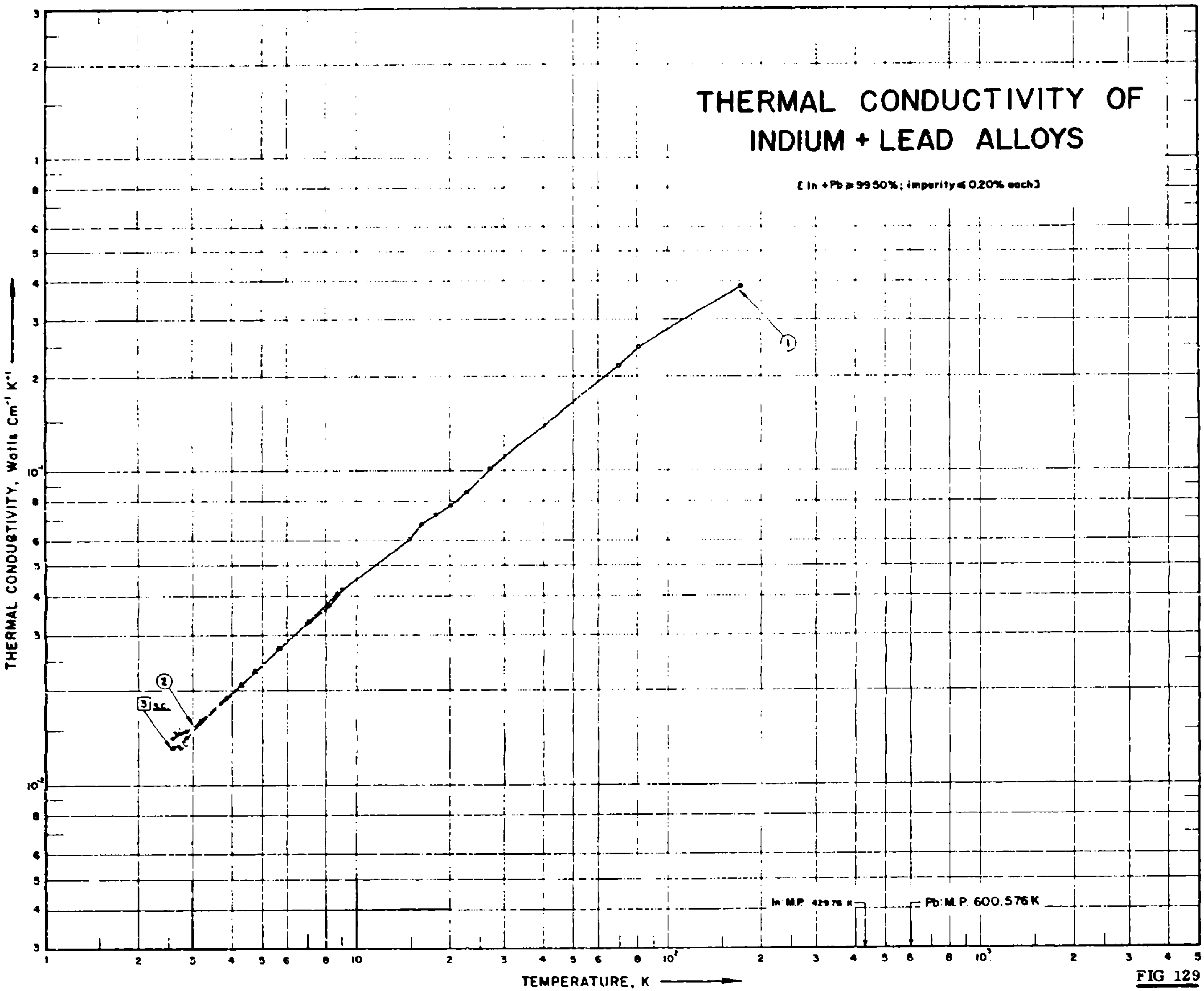
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Hf	Zr	Composition (continued), Specifications and Remarks
1	336	C	1953	323-823			~97.96	2.0	0.008 Pb, 0.007 Al, 0.006 W, 0.005 Fe, 0.004 Cu, 0.003 Zn, 0.002 each of Si, Ti and Mo, trace Sn, U, Co, Ni, Mg, Cr and Mn; specimen 2 cm in dia and 15 cm long; supplied by Westinghouse Atomic Power Division; electrical resistivity 34.1, 40.6, 47.1, 53.6, 60.1 and 66.6 μohm cm at 0, 50, 100, 150, 200 and 250 C, respectively; measured in vacuum of ~1 x 10^{-5} mm Hg; Armco iron used as comparative material.
2	151	L	1957	2.7-91		HF1	99.5-99	0.5-1.0	Specimen 5 x 1.52 mm and ~6 cm long; supplied by Foote Mineral Co.; as received; ρ_0 = 4.23 μohm cm; electrical resistivity ratio $\rho_0/\rho(295)$ = 0.1165.
3	614	R	1961	401-1578	5.0		~99	1 Max	0.1 Max Ti and Si, 0.01 Max Fe, V and Zn, 0.001 Max Mn, Ni and Cu, 0.0001 Max Mg; specimen contained 5 one-inch dia disks.

DATA TABLE NO. 128 THERMAL CONDUCTIVITY OF [HAFNIUM + ZIRCONIUM] ALLOYS

(Hf + Zr > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
323.2	0.223
373.2	0.220
423.2	0.218
473.2	0.215
523.2	0.213
573.2	0.210
623.2	0.208
673.2	0.207
723.2	0.206
773.2	0.205
823.2	0.205
CURVE 2	
2.70	0.0221
4.23	0.0370
5.96	0.0552
7.70	0.0700
10.40	0.100
14.50	0.142
20.00	0.180
25.60	0.208
31.90	0.225
55.80	0.255
65.00	0.251
77.90	0.257
90.80	0.262
CURVE 3	
400.9	0.226
737.1	0.212
848.2	0.206
1190.4	0.198
1527.6	0.191
1877.6	0.189



THERMAL CONDUCTIVITY OF
INDIUM + LEAD ALLOYS
[In + Pb ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}
TEMPERATURE, K
In M.P. 429.76 K
Pb: M.P. 600.576 K
S.C.

FIG 129

SPECIFICATION TABLE NO. 129 THERMAL CONDUCTIVITY OF [INDIUM - LEAD] ALLOYS

(In + Pb $>$ 99.50%; impurities $<$ 0.20%)

[For Data Reported in Figure and Table No. 129]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) In	Pb	Composition (continued), Specifications and Remarks
1	228	L	1936	2.6-174			85.48	14.52	Without magnetic field.
2	228	L	1936	2.6-8.8			85.48	14.52	Measured in a magnetic field of 642 gauss; less than the threshold field intensity.
3	226	L	1936	2.6-3.2			85.48	14.52	Specimen in superconducting state; measured in a magnetic field of 214 gauss.

DATA TABLE NO. 129 THERMAL CONDUCTIVITY OF (INDIUM + LEAD) ALLOYS

(In + Pb > 99.50%; Impurities < 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
2.60	0.0132
2.85	0.0142
3.18	0.0155
3.85	0.0181
4.30	0.0209
4.76	0.0230
5.69	0.0273
7.06	0.0328
8.15	0.0370
9.01	0.0420
14.9	0.0602
16.3	0.0676
18.1	0.0725
20.1	0.0775
22.7	0.0855
27.0	0.101
70.0	0.216
81.0	0.248
174.0	0.388
CURVE 2	
2.59	0.0141
2.85	0.0148
3.18	0.0160
3.85	0.0191
4.30	0.0209
4.76	0.0229
5.69	0.0273
7.06	0.0328
8.75	0.0407
CURVE 3	
2.59	0.0131
2.87	0.0140
3.18	0.0157

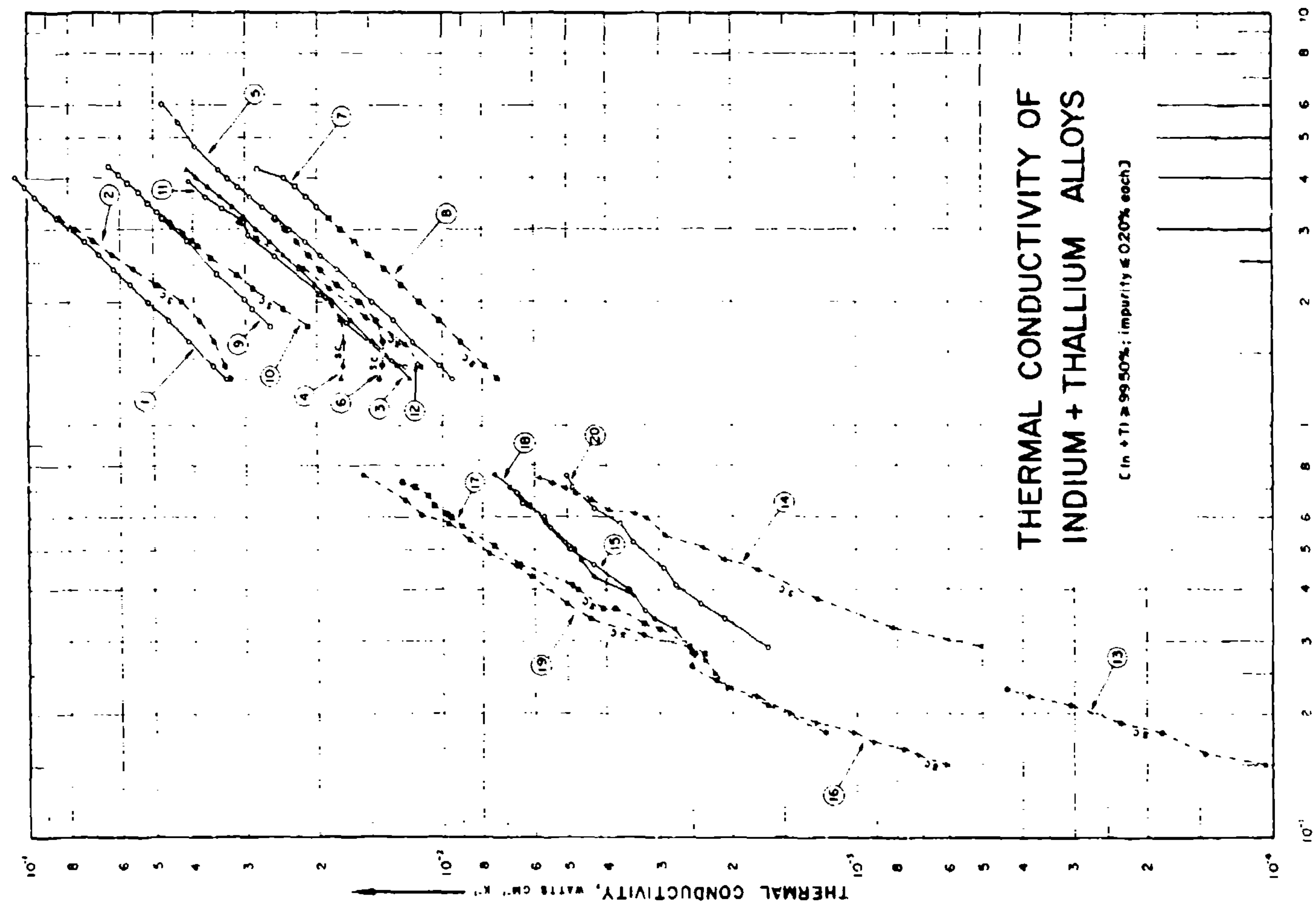

THERMAL CONDUCTIVITY OF
INDIUM + THALLIUM ALLOYS
[In + Tl ≥ 99.50%; impurity ≤ 0.20% each]
TEMPERATURE, K
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹

FIG 130

SPECIFICATION TABLE NO. 130 THERMAL CONDUCTIVITY OF INDIUM + THALLIUM ALLOYS

(In + Tl ≥ 99.50%; impurity ≤ 0.20% each)

For Data Reported in Figure and Table No. 130*

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) In	Tl	Composition (continued), Specifications and Remarks
1	132	L	1955	1.3-4.0	2.5		91.43	8.57	Calculated composition; single crystal; 0.05 impurities; annealed; critical temp (T_c) 3.28 K; critical magnetic field (H_c) 276.5 oersteds; in normal state; data extracted from smoothed curve.
2	132	L	1955	1.3-3.2	2.5		91.43	8.57	The above specimen in superconducting state.
3	132	L	1955	1.3-4.2	2.5		76.10	23.90	Similar to the above specimen except T_c = 3.252 K; H_c = 281.1 oersteds; in normal state.
4	132	L	1955	1.3-4.2	2.5		76.10	23.90	The above specimen in superconducting state.
5	132	L	1955	1.3-6.0	2.5		69.20	30.80	Similar to the above specimen except T_c = 3.223 K; H_c = 282.3 oersteds; in normal state.
6	132	L	1955	1.3-4.2	2.5		69.20	30.80	The above specimen in superconducting state.
7	132	L	1955	1.3-4.2	2.5		56.72	43.28	Calculated composition; polycrystal; 0.05 impurities; annealed; T_c = 3.308 K; data extracted from smoothed curve; in normal state.
8	132	L	1955	1.3-3.2	2.5		56.72	43.28	The above specimen in superconducting state.
9	76	L	1952	1.7-4.3			83.49	16.51	Calculated composition; <0.05 impurities; single crystal; annealed; in normal state.
10	76	L	1952	1.7-3.1			83.49	16.51	The above specimen in superconducting state.
11	107	L	1955	1.4-2.9	3-10		76.10	23.90	Calculated composition; polycrystal; error 3% below 0.4 K; in normal state.
12	107	L	1955	1.4-3.1	3-10		76.10	23.90	The above specimen in superconducting state.
13	107	L	1955	0.15-0.23	3		76.10	23.90	Calculated composition; polycrystal; copper potassium Tutton salt used as cooling agent; in superconducting state.
14	107	L	1955	0.29-0.75	3		76.10	23.90	The above specimen measured with chromium potassium alum as cooling agent, in superconducting state.
15	107	L	1955	0.35-0.69	3		76.10	23.90	The above specimen in normal state.
16	107	L	1955	0.15-0.27	3		76.10	23.90	Calculated composition; single crystal; copper potassium Tutton salt used as cooling agent; in superconducting state.
17	107	L	1955	0.28-0.73	3		76.10	23.90	The above specimen measured with chromium potassium alum as cooling agent; in superconducting state.

SPECIFICATION TABLE NO. 130 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) In	Tl	Composition (continued), Specifications and Remarks
18	107	L	1955	0.28-0.76	3		76.10	23.90	The above specimen in normal state.
19	107	L	1955	0.18-0.[illegible]	3		69.20	30.80	Calculated composition; single crystal; in superconducting state.
20	107	L	1955	0.29-0.76	3		69.20	30.80	The above specimen in normal state.

DATA TABLE NO. 130 THERMAL CONDUCTIVITY OF (INDIUM + THALLIUM) ALLOYS

(In + Tl ≥ 99.50%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

CURVE 1

T	k
1.30	0.0333
1.40	0.0358
1.60	0.0410
1.80	0.0461
2.00	0.0515
2.20	0.0570
2.40	0.0625
2.60	0.0680
2.80	0.0735
3.00	0.0790
3.20	0.0845
3.40	0.0900
3.60	0.0960
3.80	0.102
4.00	0.108

CURVE 2

T	k
1.30	0.0327
1.40	0.0335
1.60	0.0355
1.80	0.0386
2.00	0.0430
2.20	0.0490
2.40	0.0560
2.60	0.0630
2.80	0.0700
3.00	0.0770
3.20	0.0840

CURVE 3

T	k
1.30	0.0120
1.40	0.0129
1.60	0.0148
1.80	0.0156
2.00	0.0184
2.20	0.0203
2.40	0.0222
2.60	0.0241
2.80	0.0260
3.00	0.0281
3.20	0.0302
3.40	0.0323
3.60	0.0344

CURVE 3 (cont.)

T	k
3.80	0.0368
4.00	0.0392
4.20	0.0417

CURVE 4

T	k
1.30	0.0176
1.40	0.0174
1.60	0.0173
1.80	0.0176
2.00	0.0185
2.20	0.0203
2.40	0.0222
2.60	0.0241
2.80	0.0260
3.00	0.0281
3.20	0.0302

CURVE 5

T	k
1.30	0.0093
1.40	0.0102
1.60	0.0117
1.60	0.0131
2.00	0.0147
2.20	0.0163
2.40	0.0179
2.60	0.0196
2.80	0.0214
3.00	0.0233
3.20	0.0252
3.40	0.0272
3.60	0.0293
3.80	0.0312
4.00	0.0330
4.20	0.0346
4.78	0.0396
5.44	0.0438
6.04	0.0479

CURVE 6

T	k
1.30	0.0142
1.40	0.0140
1.60	0.0139

CURVE 6 (cont.)

T	k
1.80	0.0145
2.00	0.0158
2.20	0.0175
2.40	0.0196
2.60	0.0210
2.80	0.0224
3.00	0.0239
3.20	0.0253

CURVE 7

T	k
1.30	0.00735
1.40	0.00790
1.60	0.00905
1.80	0.0102
2.00	0.0114
2.20	0.0126
2.40	0.0138
2.60	0.0150
2.80	0.0162
3.00	0.0175
3.20	0.0187
3.40	0.0200
3.60	0.0213
3.80	0.0226
4.00	0.0240
4.20	0.0280

CURVE 8

T	k
1.30	0.00735
1.40	0.00790
1.60	0.00995
1.80	0.0102
2.00	0.0114
2.20	0.0126
2.40	0.0138
2.60	0.0150
2.80	0.0162
3.00	0.0175
3.20	0.0187

CURVE 9

T	k
1.75	0.0260
1.93	0.0288
2.02	0.0301
2.35	0.0351
2.82	0.0416
3.19	0.0474
3.32	0.0490
3.48	0.0515
3.69	0.0541
3.89	0.0575
4.09	0.0605
4.27	0.0641

CURVE 10

T	k
1.75	0.0211
1.93	0.0241
2.16	0.0288
2.33	0.0315
2.57	0.0362
2.75	0.0390
2.82	0.0403
2.94	0.0425
3.10	0.0455

CURVE 11

T	k
1.39	0.0123
1.44	0.0133
1.77	0.0169
2.11	0.0193
2.58	0.0251
2.90	0.0295
3.13	0.0302
3.39	0.0340
3.63	0.0374
3.91	0.0410

CURVE 12

T	k
1.39	0.0113
1.57	0.0123
1.84	0.0153
2.16	0.0187
2.42	0.0216
2.85	0.0280
3.12	0.0310

CURVE 13

T	k
0.15	0.000165
0.16	0.000145
0.18	0.000165
0.19	0.000232
0.21	0.000305
0.22	0.000385
0.23	0.000437

CURVE 14

T	k
0.291	0.000500
0.323	0.000818
0.377	0.00123
0.416	0.00173
0.473	0.00209
0.509	0.00235
0.540	0.00290
0.596	0.00323
0.610	0.00345
0.625	0.00395
0.660	0.00432
0.683	0.00473
0.705	0.00505
0.725	0.00545
0.745	0.00586

CURVE 15

T	k
0.355	0.00325
0.400	0.00355
0.460	0.00430
0.500	0.00490
0.565	0.00550
0.600	0.00570
0.630	0.00640
0.690	0.00660

CURVE 16

T	k
0.150	0.000610
0.158	0.000715
0.164	0.000770
0.170	0.000905
0.180	0.00101
0.190	0.00125
0.200	0.00145
0.220	0.00174

CURVE 16 (cont.)

T	k
0.230	0.00205
0.250	0.00220
0.270	0.00231

CURVE 17

T	k
0.28	0.00232
0.32	0.00300
0.33	0.00327
0.36	0.00382
0.36	0.00409
0.40	0.00468
0.41	0.00482
0.46	0.00650
0.51	0.00745
0.57	0.00900
0.60	0.00955
0.61	0.00960
0.64	0.0105
0.68	0.0107
0.71	0.0116
0.73	0.0125

CURVE 18

T	k
0.28	0.00250
0.32	0.00275
0.34	0.00310
0.396	0.00355
0.410	0.00430
0.47	0.00460
0.50	0.00470
0.54	0.00525
0.58	0.00565
0.64	0.00615
0.68	0.00655
0.71	0.00685
0.76	0.00745

CURVE 19

T	k
0.18	0.00118
0.21	0.00164
0.24	0.00218
0.26	0.00250
0.28	0.00246
0.29	0.00252

CURVE 19 (cont.)

T	k
0.31	0.00328
0.34	0.00437
0.37	0.00500
0.43	0.00610
0.46	0.00660
0.49	0.00770
0.53	0.00860
0.58	0.00970
0.61	0.0112
0.66	0.0122
0.76	0.0155

CURVE 20

T	k
0.29	0.00164
0.34	0.00209
0.37	0.00237
0.41	0.00273
0.45	0.00293
0.52	0.00346
0.58	0.00373
0.63	0.00428
0.71	0.00482
0.76	0.00500

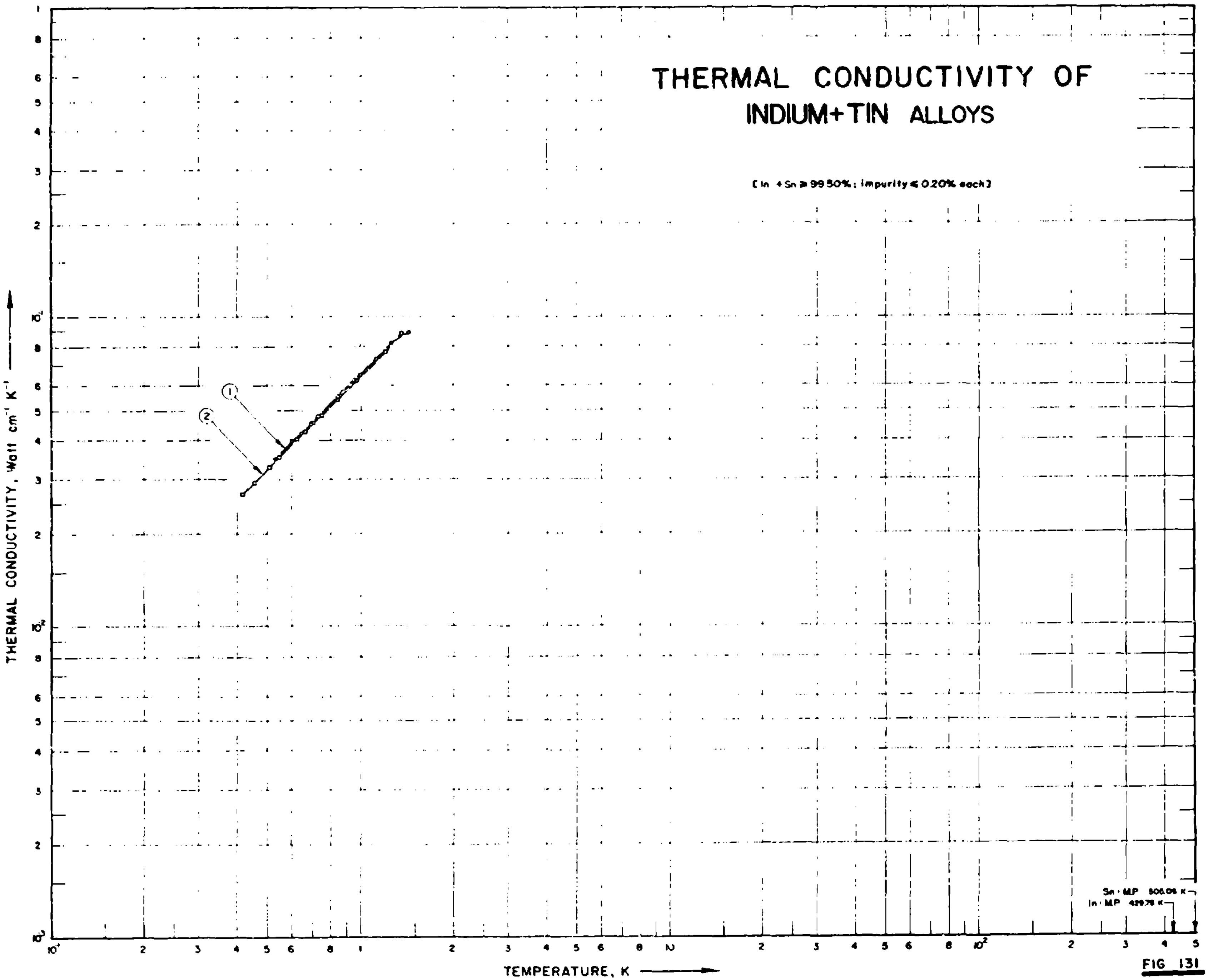

THERMAL CONDUCTIVITY OF
INDIUM+TIN ALLOYS
(In + Sn ≥ 99.50%; impurity ≤ 0.20% each)
Sn: MP 505.06 K
In: MP 429.78 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2

FIG 131

SPECIFICATION TABLE NO. 131 THERMAL CONDUCTIVITY OF (INDIUM + TIN) ALLOYS

(In + Sn ≥ 99.50%; impurities ≤ 0.20%)

[For Data Reported in Figure and Table No. 131]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) In	Sn	Composition (continued), Specifications and Remarks
1	880	L	1965	0.5-1.3	±1	In 1	99	1	Supplied by American Smelting and Refining Co.; a rod of 3 mm dia; annealed at 130 C for six months; electrical resistivity 0.37 x 10^{-6} ohm cm at 4.2 K; normal-state conductivity was measured in a longitudinal magnetic field of 900 gauss.
2	880	L	1965	0.4-1.4	±1	In 2			The above specimen bent repeatedly at room temperature before the measurement.

DATA TABLE NO. 131 THERMAL CONDUCTIVITY OF [INDIUM + TIN] ALLOYS

(In + Sn > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
0.532	0.0349
0.600	0.0398
0.646	0.0424
0.691	0.0454
0.731	0.0480
0.845	0.0552
0.950	0.0622
0.992	0.0649
1.103	0.0731
1.260	0.0822
1.342	0.0888
CURVE 2	
0.418	0.0268
0.455	0.0292
0.509	0.0328
0.548	0.0354
0.625	0.0404
0.661	0.0428
0.703	0.0456
0.748	0.0483
0.845	0.0543
0.971	0.0622
1.012	0.0648*
1.125	0.0722*
1.202	0.0772
1.365	0.0882

* Not shown on plot

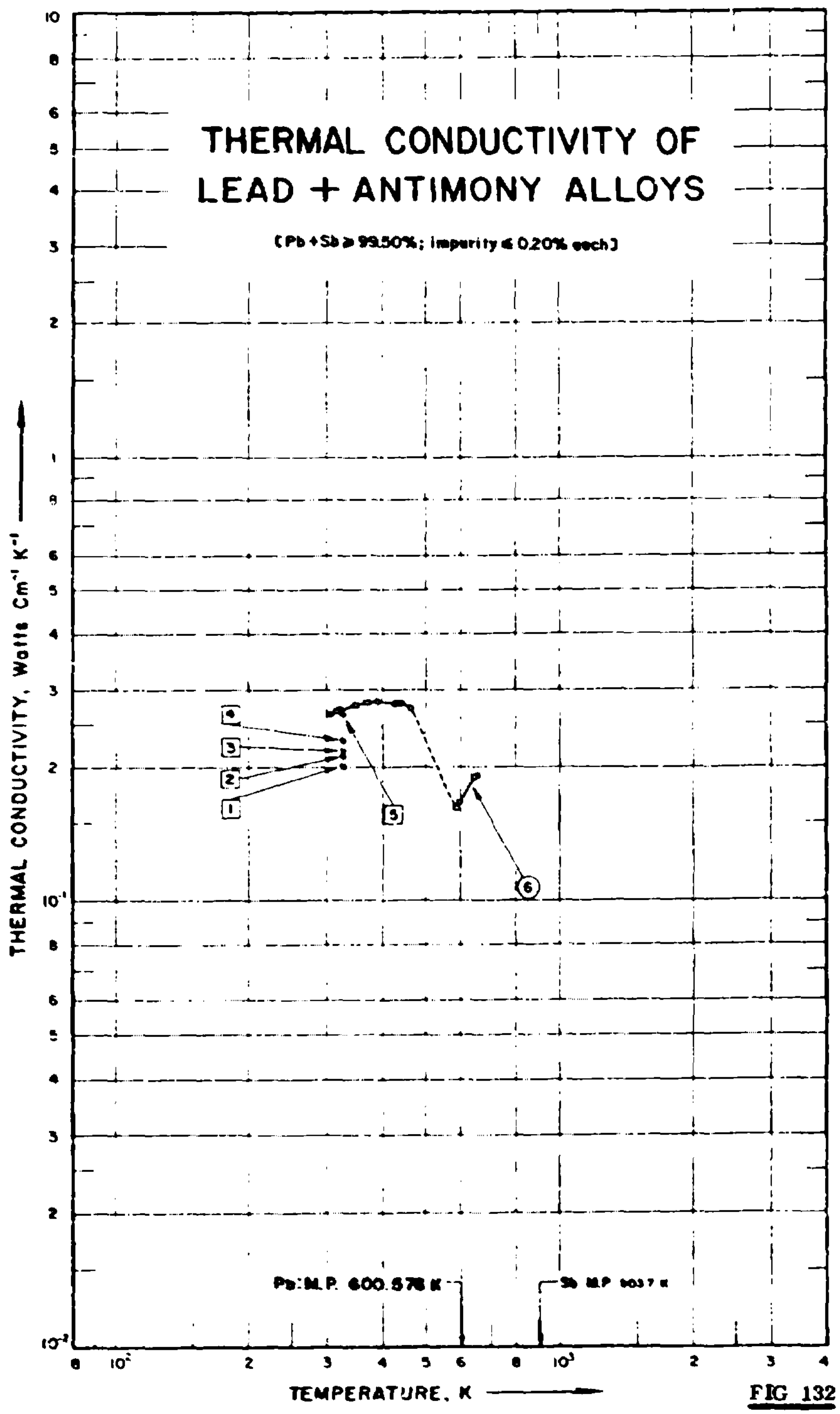

THERMAL CONDUCTIVITY OF
LEAD + ANTIMONY ALLOYS
(Pb + Sb ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Pb: M.P. 600.576 K
1
2
3
4
5
6

FIG 132

SPECIFICATION TABLE NO. 132 THERMAL CONDUCTIVITY OF LEAD + ANTIMONY ALLOYS

(Pb + Sb > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 132]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pb	Sb	Composition (continued), Specifications and Remarks
1	230	L	1925	327			50	50	Prepared by fusing Pb and Sb each containing < 0.03 impurities; supplied by Baker; specimen 10 cm long 1.9 cm dia; electrical conductivity 2.46×10^4 ohm^{-1} cm^{-1} at 22 C.
2	230	L	1925	327			60	40	Similar to the above specimen except electrical conductivity 2.66×10^4 ohm^{-1} cm^{-1} at 22 C.
3	230	L	1925	327			70	30	Similar to the above specimen except electrical conductivity 2.87×10^4 ohm^{-1} cm^{-1} at 22 C.
4	230	L	1925	327			80	20	Similar to the above specimen except electrical conductivity 3.10×10^4 ohm^{-1} cm^{-1} at 22 C.
5	230	L	1925	327			90	10	Similar to the above specimen except electrical conductivity 3.60×10^4 ohm^{-1} cm^{-1} at 22 C.
6	19	L	1923	307-455			87	13	Eutectic alloy; melting point 248 C; specimen 1.5 cm dia, 12 cm long.

DATA TABLE NO. 132 THERMAL CONDUCTIVITY OF [LEAD + ANITMONY] ALLOYS

(Pb + Sb 99.50%; impurity 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
327	0.261
CURVE 2	
327	0.213
CURVE 3	
327	0.218
CURVE 4	
327	0.230
CURVE 5	
327	0.264
CURVE 6	
307.2	0.264
316.2	0.267
324.2	0.269
349.2	0.277
370.2	0.280
392.2	0.281
428.2	0.278
441.2	0.279
463.2	0.272
589.2	0.162
599.2	0.166
645.2	0.190
655.2	0.191

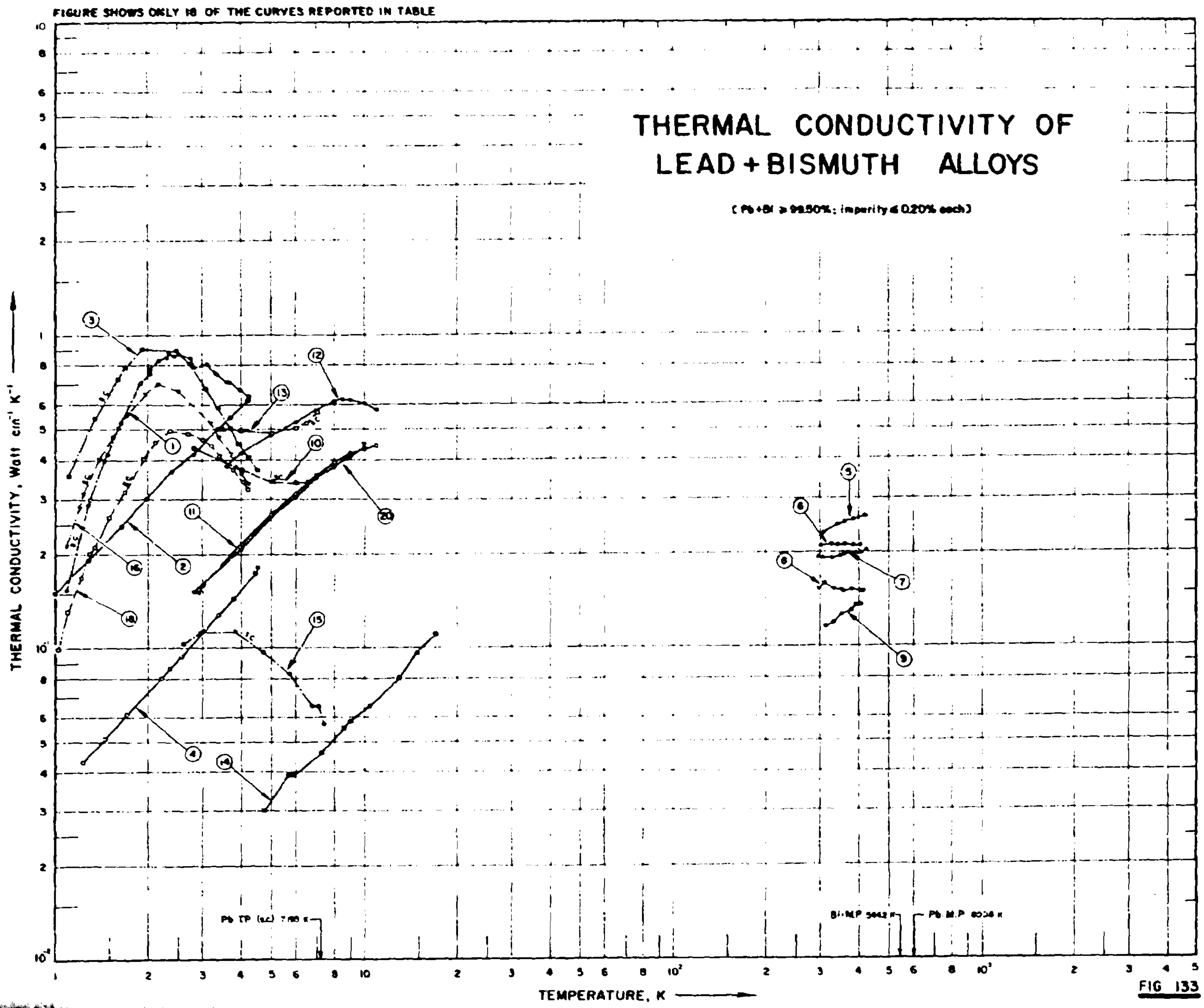


FIGURE SHOWS ONLY 18 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
LEAD + BISMUTH ALLOYS
(Pb+Bi ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 133

SPECIFICATION TABLE NO. 133 THERMAL CONDUCTIVITY OF [LEAD + BISMUTH] ALLOYS

(Pb + Bi ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 133]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pb	Bi	Composition (continued), Specifications and Remarks
1	257	L	1958	1.1-4.3	±2	Pb-Bi 0.2	99.798	0.202	Polycrystal; grain size 0.5 mm; annealed in vacuo for several hr close to the melting point; in superconducting state.
2	257	L	1958	1.0-4.2	±2	Pb-Bi 0.2	99.798	0.202	The above specimen measured in a magnetic field of 1000 gauss; in normal state.
3	257	L	1958	1.1-4.5	±2	Pb-Bi 0.7	99.284	0.716	Single crystal; annealed in vacuo for several days close to the melting point; in superconducting state.
4	257	L	1958	1.2-4.5	±2	Pb-Bi 0.7	99.284	0.716	The above specimen measured in a magnetic field of 1000 gauss; in normal state.
5	248	E	1956	308-421	±3		89.80	10.20	
6	248	E	1956	302-406	±3		85.88	14.12	
7	248	E	1956	296-425	±3		78.34	21.66	
8	248	E	1956	298-415	±3		72.74	27.26	
9	248	E	1956	311-405	±3		61.15	38.85	
10	468	L	1952	2.8-6.6			99.5	0.5	In superconducting state.
11	468	L	1952	2.9-11			99.5	0.5	The above specimen in normal state.
12	468	L	1952	3.6-11			99.8	0.2	In normal state.
13	468	L	1952	3.5-7.6			99.8	0.2	The above specimen in superconducting state.
14	96	L	1950	4.8-17			90	10	In normal state.
15	96	L	1950	2.6-7.4			90	10	The above specimen in superconducting state.
16	389	L	1958	1.0-4.3			99	1	Specimen straight; annealed; measured in superconducting state.
17	389	L	1958	1.0-4.2			99	1	The above specimen bent; measured in superconducting state.
18	389	L	1958	1.0-4.2			99	1	The above specimen annealed at room temp; measured in superconducting state.

DATA TABLE NO. 133 THERMAL CONDUCTIVITY OF [LEAD + BISMUTH] ALLOYS

(Pb + Bi ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
1.09	0.154
1.28	0.286
1.30	0.298
1.45	0.397
1.49	0.418
1.61	0.503
1.64	0.522
1.90	0.700
2.04	0.754
2.04	0.774
2.17	0.825
2.30	0.841
2.35	0.876
2.43	0.851
2.53	0.866
2.76	0.841
2.83	0.781
3.11	0.806
3.29	0.754
3.35	0.750
3.61	0.704
3.67	0.702
3.98	0.663
4.25	0.638
CURVE 2	
1.00	0.150
1.28	0.191
1.64	0.245
1.95	0.300
2.39	0.367
2.82	0.418
3.39	0.500
3.71	0.549
4.24	0.620
CURVE 3	
1.12	0.356
1.35	0.540
1.61	0.727
CURVE 3 (cont.)	
1.69	0.782
1.93	0.900
2.47	0.890
2.74	0.806
3.09	0.675
3.36	0.586
3.69	0.500
3.94	0.449
4.23	0.403
4.50	0.371
CURVE 4	
1.23	0.0434
1.45	0.0520
1.70	0.0615
2.21	0.0801
2.36	0.0860
2.58	0.0938
3.01	0.1125
3.38	0.1275
3.75	0.144
4.44	0.174
4.52	0.1805
CURVE 5	
303.2	0.228
343.4	0.242
363.4	0.247
386.2	0.253
420.7	0.259
CURVE 6	
301.7	0.207
326.7	[illegible]10
342.7	[illegible]09
361.2	0.210
385.2	0.209
405.7	0.208
CURVE 7	
296.2	0.192
306.2	0.190
326.2	0.190
349.2	0.192
358.2	0.196
394.2	0.197
408.2	0.197
425.2	0.203
CURVE 8	
298.2	0.151
310.2	0.159
332.2	0.151
352.2	0.150
356.2	0.149
380.2	0.151
409.2	0.149
415.2	0.149
CURVE 9	
311.2	0.115
331.2	0.118
352.2	0.126
377.2	0.130
390.2	0.135
405.2	0.135
CURVE 10	
2.8	0.435
3.0	0.423*
4.0	0.372
5.0	0.340
6.0	0.337
6.6	0.340
CURVE 11	
2.9	0.150
3.0	0.158
CURVE 11 (cont.)	
4.0	0.215
5.0	0.265
6.0	0.310
7.0	0.355
8.0	0.389
9.0	0.415
10.0	0.430
11.0	0.440
CURVE 12	
3.6	0.380
4.0	0.420
5.0	0.475
6.0	0.525
7.0	0.575
8.0	0.610
8.5	0.620
9.0	0.615
10.0	0.600
11.0	0.575
CURVE 13	
3.5	0.500
4.0	0.495
5.0	0.480
6.0	0.500
6.5	0.525
7.0	0.570
CURVE 14	
4.75	0.0[illegible]
5.70	0.939
5.90	0.039
7.25	0.046
8.55	0.055
9.00	0.058
10.40	0.065
13.00	0.080
14.75	0.096
17.00	0.110
CURVE 15	
2.60	0.103
3.00	0.112
3.80	0.113
4.70	0.097
5.70	0.083
6.80	0.065
7.10	0.065
7.40	0.057
CURVE 16	
0.997	0.150*
1.095	0.212
1.210	0.280
1.245	0.310
1.39	0.400
1.56	0.470
1.72	0.556
1.98	0.648
2.17	0.690
2.52	0.660
3.20	0.529
3.41	0.470
3.74	0.408
4.03	0.360
4.25	0.336
CURVE 17*	
0.997	0.128
1.06	0.172
1.13	0.222
1.30	0.308
1.37	0.350
1.52	0.420
1.70	0.510
1.93	0.610
2.13	0.680
2.40	0.695
2.75	0.620
3.09	0.560
3.25	0.508
3.50	0.460
CURVE 17 (cont.)*	
4.10	0.355
4.23	0.348
CURVE 18	
0.997	0.085*
1.035	0.100
1.105	0.131
1.225	0.167
1.305	0.20
1.352	0.21
1.500	0.26
1.698	0.315
1.96	0.40
2.12	0.45
2.38	0.49
2.70	0.48
3.02	0.46
3.23	0.44
3.44	0.41
3.78	0.37
4.08	0.34
4.21	0.32

* Not shown on plot

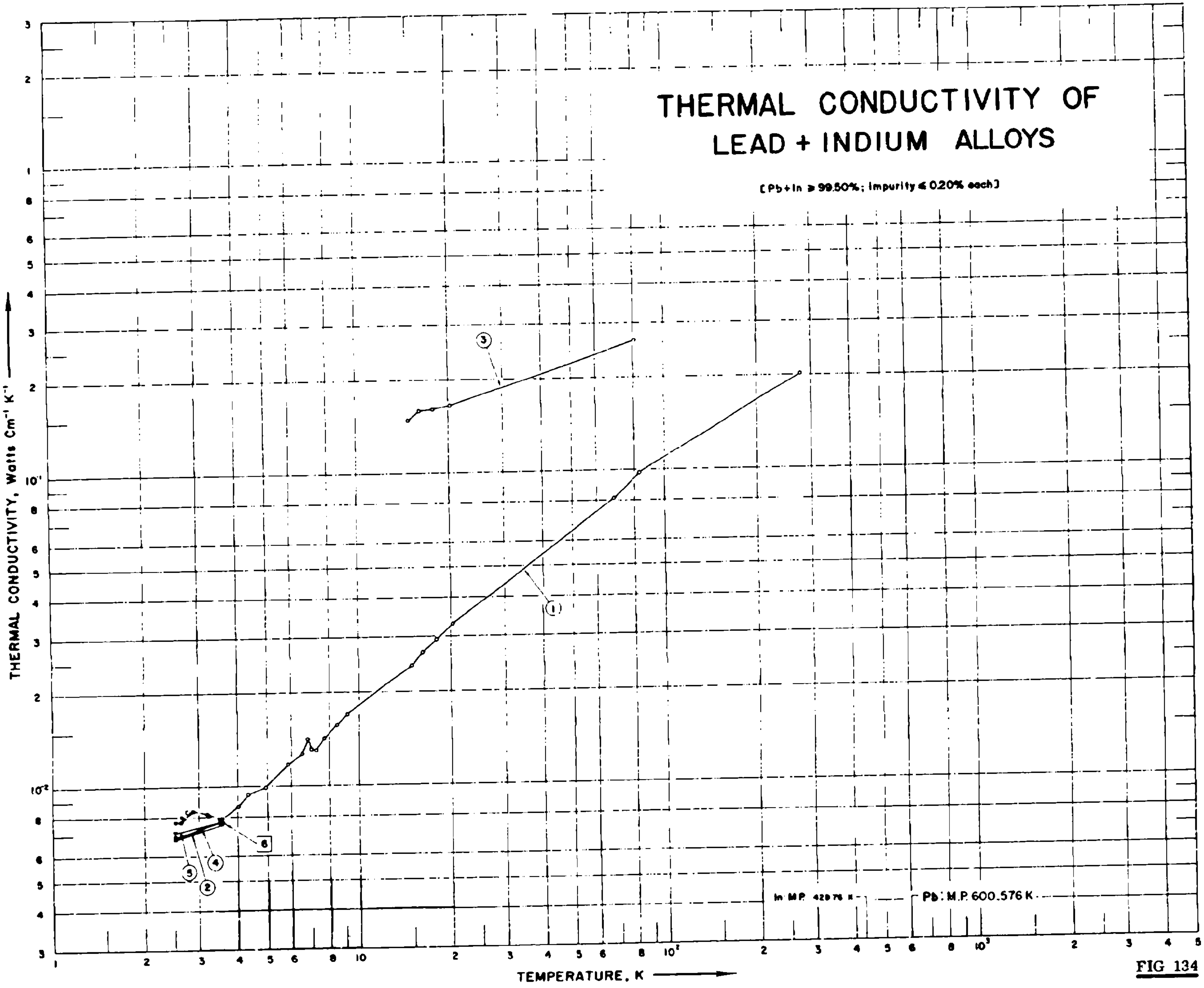

THERMAL CONDUCTIVITY OF
LEAD + INDIUM ALLOYS
[Pb+In ≥ 99.50%; Impurity ≤ 0.20% each]
In: M.P. 429.76 K
Pb: M.P. 600.576 K
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}
TEMPERATURE, K
1
2
3
4
5
6

FIG 134

SPECIFICATION TABLE NO. 134 THERMAL CONDUCTIVITY OF [LEAD + INDIUM] ALLOYS

(Pb + In > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 134]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pb	In	Composition (continued), Specifications and Remarks
1	228	L	1936	2.5-278			64.35	35.65	Calculated composition; specimen in superconducting state at lower temp.
2	228	L	1936	2.5,3.6			64.35	35.65	The above specimen measured in a magnetic field of 721 gauss (below critical field strength).
3	228	L	1936	15-81			99.444	0.556	Calculated composition.
4	228	L	1936	2.5,3.6			64.35	35.65	Calculated composition; measured in a magnetic field of 481 gauss.
5	228	L	1936	2.5,3.6			64.35	35.65	The above specimen measured in a magnetic field of 240 gauss.
6	228	L	1936	3.56			64.35	35.65	The above specimen measured in a magnetic field of 601 gauss.

DATA TABLE NO. 134 THERMAL CONDUCTIVITY OF [LEAD + INDIUM] ALLOYS

(Pb + In ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
2.51	0.00769
2.64	0.00769
2.87	0.00833
3.20	0.00813
3.56	0.00787
4.02	0.00862
4.36	0.00943
4.94	0.00990
5.87	0.0117
6.52	0.0127
6.81	0.0141
7.02	0.0132
7.25	0.0131
7.69	0.0143
8.45	0.0157
9.16	0.0170
14.90	0.0242
16.30	0.0267
18.00	0.0293
20.40	0.0326
69.00	0.0813
83.00	0.0980
278.00	0.202
CURVE 2	
2.53	0.00676
3.56	0.00752
CURVE 3	
14.80	0.149
16.10	0.158
17.90	0.160
20.40	0.165
81.00	0.263
CURVE 4	
2.53	0.00680
3.56	0.00769
CURVE 5	
2.52	0.00709
3.56	0.00769
CURVE 6	
3.56	0.00763

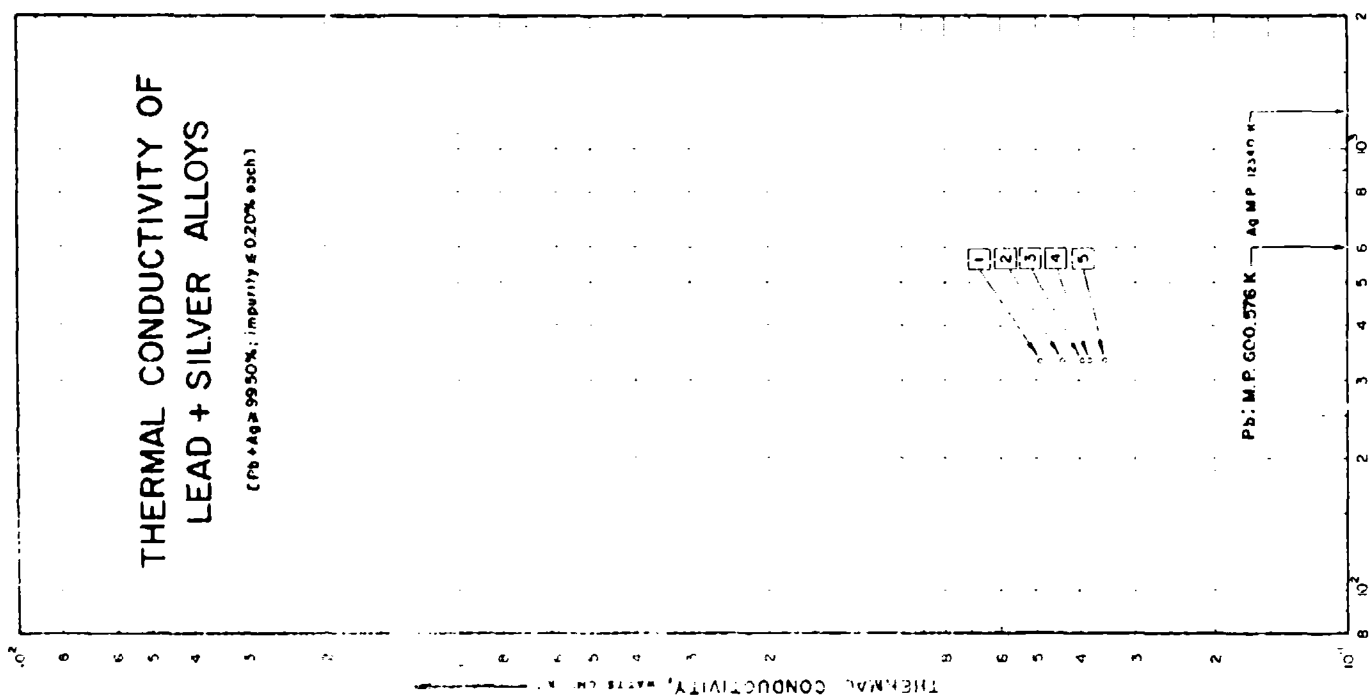

THERMAL CONDUCTIVITY OF
LEAD + SILVER ALLOYS
(Pb + Ag ≥ 99.50%; impurity ≤ 0.20% each)
Pb: M.P. 600.576 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹

FIG 135

SPECIFICATION TABLE NO. 135 THERMAL CONDUCTIVITY OF LEAD + SILVER ALLOYS

(Pb + Ag ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 135]

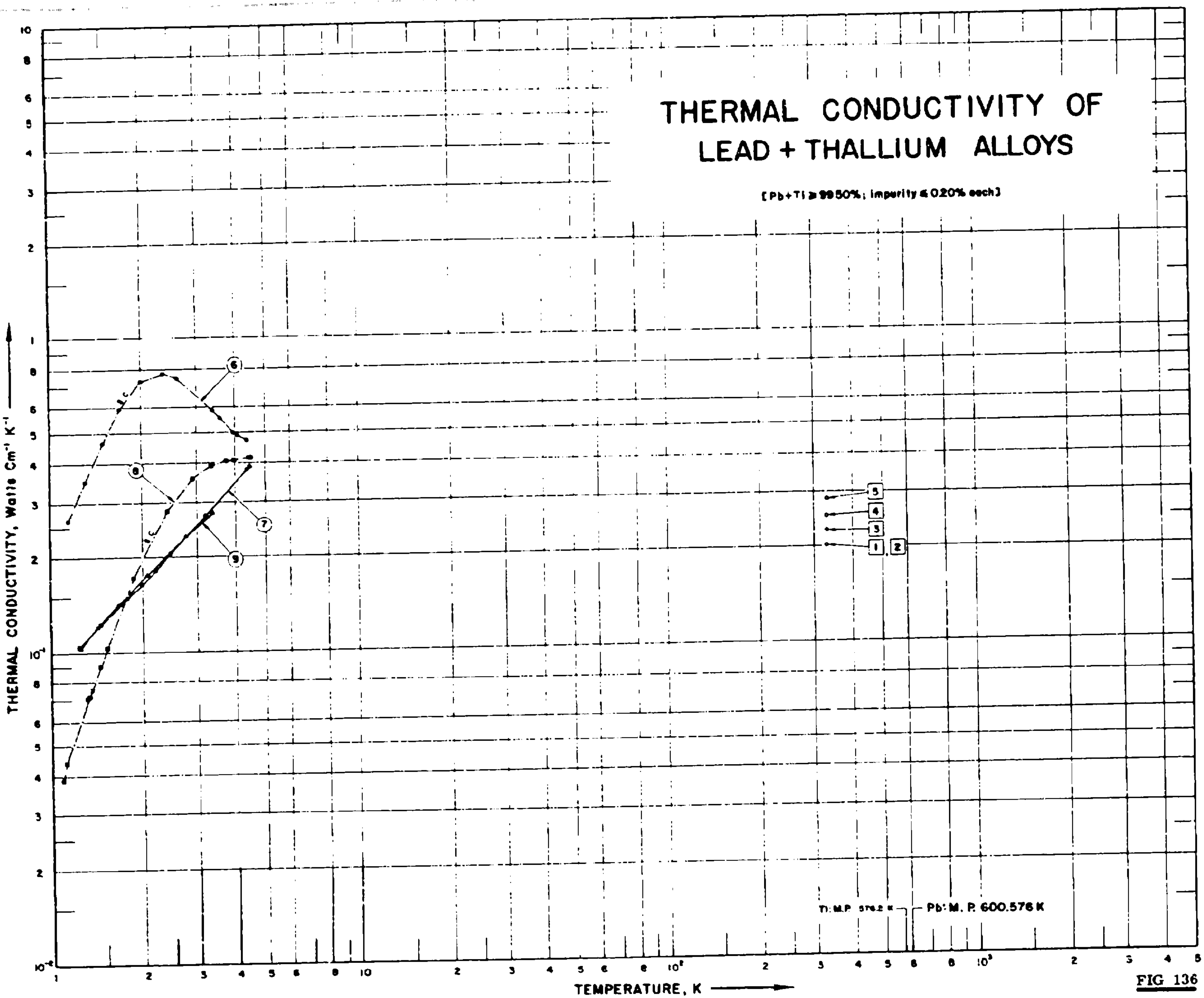
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pb	Ag	Composition (continued), Specifications and Remarks
1	230	L	1925	333			50	50	Prepared by fusing Pb (< 0.03 impurities, supplied by Bakert) and Ag (99.9 pure); specimen 5.5 cm long, 0.3 cm² cross sectional area; electrical conductivity 6.15×10^{4} ohm^{-1} cm^{-1} at 22 C.
2	230	L	1925	333			60	40	Similar to the above specimen except electrical conductivity 6.21×10^{4} ohm^{-1} cm^{-1} at 22 C.
3	230	L	1925	333			70	30	Similar to the above specimen except electrical conductivity 4.95×10^{4} ohm^{-1} cm^{-1} at 22 C.
4	230	L	1925	333			80	20	Similar to the above specimen except electrical conductivity 1.88×10^{4} ohm^{-1} cm^{-1} at 22 C.
5	230	L	1925	333			90	10	Similar to the above specimen except electrical conductivity 4.57×10^{4} ohm^{-1} cm^{-1} at 22 C.

DATA TABLE NO. 135 THERMAL CONDUCTIVITY OF [LEAD + SILVER] ALLOYS

(Pb + Ag > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
333	0.490
CURVE 2	
333	0.439
CURVE 3	
333	0.395
CURVE 4	
333	0.381
CURVE 5	
333	0.351



THERMAL CONDUCTIVITY OF
LEAD + THALLIUM ALLOYS
[Pb+Tl ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Tl: M.P. 576.2 K
Pb: M.P. 600.576 K

FIG 136

SPECIFICATION TABLE NO. 136 THERMAL CONDUCTIVITY OF (LEAD + THALLIUM) ALLOYS

(Pb + Tl ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 136]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pb	Tl	Composition (continued), Specifications and Remarks
1	230	L	1925	333			50	50	Prepared by fusing Pb (< 0.03 impurities, supplied by Baker) and Tl (technically pure, supplied by Eimer and Amend); specimen ~5.5 cm long, 0.3 cm^2 cross sectional area; electrical conductivity at 25 C 2.54 x 10^4 ohm^{-1} cm^{-1}.
2	230	L	1925	333			60	40	Similar to the above specimen except electrical conductivity 2.62 x 10^4 ohm^{-1} cm^{-1} at 25 C.
3	230	L	1925	333			70	30	Similar to the above specimen except electrical conductivity 2.74 x 10^4 ohm^{-1} cm^{-1} at 25 C.
4	230	L	1925	333			80	20	Similar to the above specimen except electrical conductivity 2.98 x 10^4 ohm^{-1} cm^{-1} at 25 C.
5	230	L	1925	333			90	10	Similar to the above specimen except electrical conductivity 3.54 x 10^4 ohm^{-1} cm^{-1} at 25 C.
6	379, 257	L	1956	1.2-4.4	± 2	PbTl 0.6	99.428	0.572	Polycrystal (long crystals); annealed in vacuo close to melting point for several hrs; in superconducting state.
7	379, 257	L	1956	1.2-4.5	± 2	PbTl 0.6	99.428	0.572	The above specimen measured in a magnetic field of 1000 gauss, in normal state.
8	379, 257	L	1956	1.1-4.5	± 2	PbTl 0.6	99.428	0.572	Similar to the above specimen except strained; in superconducting state.
9	379, 257	L	1956	1.3-4.4	± 2	PbTl 0.6	99.428	0.572	The above specimen measured in a magnetic field of 1000 gauss, in normal state.

DATA TABLE NO. 136 THERMAL CONDUCTIVITY OF [LEAD + THALLIUM] ALLOYS

(Pb + Tl ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		CURVE 8	
333	0.201	1.08	0.0389
		1.12	0.0440
CURVE 2		1.32	0.0707
		1.34	0.0715
333	0.201	1.36	0.0754
		1.45	0.0900
CURVE 3		1.53	0.1025
		1.86	0.172
333	0.226	2.42	0.282
		2.93	0.356
CURVE 4		3.36	0.390
		3.77	0.403
333	0.251	4.00	0.407
		4.48	0.416
CURVE 5		4.48	0.420
333	0.285	CURVE 9	
CURVE 6		1.25	0.1038
		1.42	0.118
1.15	0.264	1.67	0.141
1.31	0.349	2.08	0.176
1.49	0.468	2.77	0.233
1.70	0.593	4.38	0.377
1.99	0.735		
2.36	0.778		
2.62	0.750		
3.41	0.586		
3.60	0.553		
3.97	0.498		
4.11	0.490		
4.40	0.471		
CURVE 7			
1.24	0.104		
1.46	0.121		
1.71	0.142		
1.78	0.149		
1.98	0.164		
2.21	0.182		
2.47	0.205		
3.22	0.273		
4.40	0.380		
4.49	0.388		

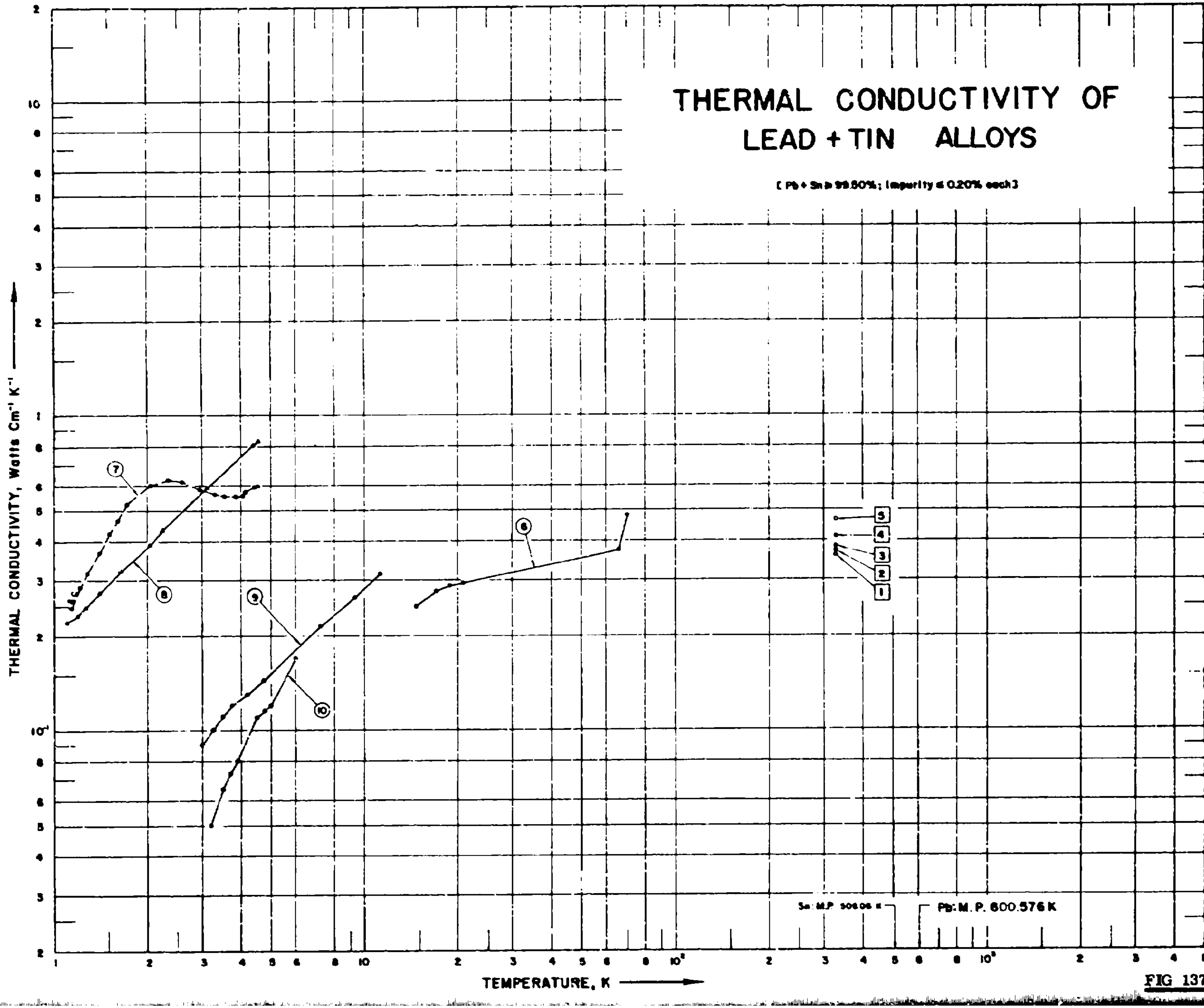

THERMAL CONDUCTIVITY OF
LEAD + TIN ALLOYS
[Pb + Sn ≥ 99.80%; Impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Sn: M.P. 505.06 K
Pb: M.P. 600.576 K
1
2
3
4
5
6
7
8
9
10

FIG 137

SPECIFICATION TABLE NO. 137 THERMAL CONDUCTIVITY OF [LEAD + TIN] ALLOYS

(Pb + Sn > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 137]

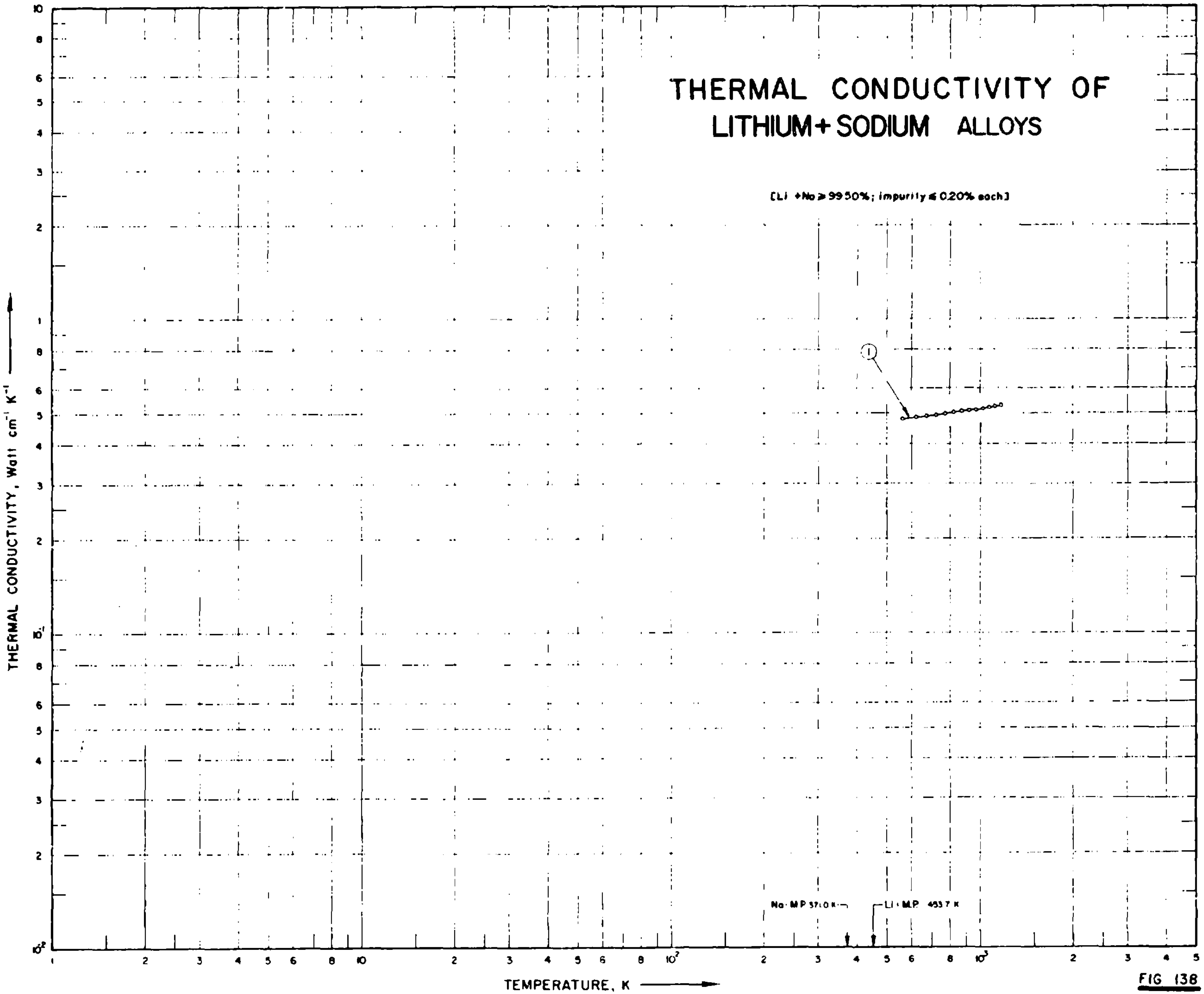
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pb	Sn	Composition (continued), Specifications and Remarks
1	230	L	1925	327.2			90	10	Approx. composition; < 0.03 total impurity in each metal; specimen 1.9 cm in dia and 10 cm long; supplied by Baker; electrical conductivity 4.95 x 10^4 ohm^{-1} cm^{-1} at 22 C.
2	230	L	1925	327.2			80	20	Similar to the above specimen except electrical conductivity 5.29 x 10^4 ohm^{-1} cm^{-1} at 22 C.
3	230	L	1925	327.2			70	30	Similar to the above specimen except electrical conductivity 5.65 x 10^4 ohm^{-1} cm^{-1} at 22 C.
4	230	L	1925	327.2			60	40	Similar to the above specimen except electrical conductivity 5.99 x 10^4 ohm^{-1} cm^{-1} at 22 C.
5	230	L	1925	327.2			50	50	Similar to the above specimen except electrical conductivity 6.47 x 10^4 ohm^{-1} cm^{-1} at 22 C.
6	228	L	1936	15-70			56.0	44.0	No other details reported.
7	257	L	1958	1.1-4.5	±2.0	PbSn 0.5	99.73	0.27	Pb (99.99 pure) supplied by Johnson Matthey; specimen 7 cm long, 3 mm in dia; polycrystal with grain size 0.1 mm; annealed in vacuo for several hrs at a temp a few degrees below the melting point; in superconducting state; ρ_0 = 0.124 μ ohm cm.
8	257	L	1958	1.1-4.6	±2.0	PbSn 0.5	99.73	0.27	The above specimen in normal state at 1000 gauss.
9	96	L	1950	3.0-11			70.0	30	Approx. composition; measured in normal state.
10	96	L	1950	3.2-6.0			70	30	Approx. composition; measured in superconducting state.

DATA TABLE NO. 137 THERMAL CONDUCTIVITY OF [LEAD + TIN] ALLOYS

(Pb + Sn ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		CURVE 7(cont.)	
327	0.360	4.05	0.558
		4.14	0.575
CURVE 2		4.42	0.595
		4.53	0.596
327	0.372		
		CURVE 8	
CURVE 3			
		1.10	0.222
327	0.385	1.19	0.233
		1.27	0.248
CURVE 4		1.40	0.275
		1.64	0.322
327	0.414	2.04	0.392
		2.23	0.436
CURVE 5		3.10	0.595
		4.38	0.810
327	0.464	4.56	0.835
CURVE 6		CURVE 9	
14.7	0.249	3.0	0.090
17.1	0.276	3.2	0.100
18.9	0.287	3.5	0.110
20.8	0.294	3.7	0.120
66.0	0.377	4.2	0.130
70.0	0.483	4.7	0.145
		7.2	0.215
CURVE 7		9.3	0.265
		11.3	0.315
1.14	0.246		
1.22	0.286	CURVE 10	
1.28	0.316		
1.40	0.368	3.2	0.050
1.51	0.424	3.5	0.065
1.61	0.469	3.7	0.072
1.72	0.525	3.9	0.080
2.05	0.602	4.5	0.110
2.33	0.630	4.8	0.115
2.59	0.620	5.0	0.120
2.95	0.584	6.0	0.170
3.30	0.562		
3.55	0.550		
3.87	0.553		



THERMAL CONDUCTIVITY OF
LITHIUM + SODIUM ALLOYS
[Li + Na ≥ 99.50%; impurity ≤ 0.20% each]
1
Na: M.P. 371.0 K
Li: M.P. 453.7 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 138

SPECIFICATION TABLE NO. 138 THERMAL CONDUCTIVITY OF [LITHIUM + SODIUM] ALLOYS

(Li + Na > 99.50%; impurity < 0.20%)

[For Data Reported in Figure and Table No. 138]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Li	Na	Composition (continued), Specifications and Remarks
1	922, 923	C	1965	563-1193	±8		Bal.	0.26	0.0072 N, 0.0063 Ca, 0.0011 K, 0.06 other impurities; specimen filled in a type 1Kh 18 N9T steel container 14-15 mm in dia and 220 mm long; Armco iron used as comparative material; thermal conductivity data calculated from smooth curve.

DATA TABLE NO. 138 THERMAL CONDUCTIVITY OF [LITHIUM + SODIUM] ALLOYS

(Li + Na > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
563.2	0.480
573.2	0.481*
623.2	0.485
673.2	0.490
723.2	0.493
773.2	0.497
823.2	0.501
873.2	0.506
923.2	0.510
973.2	0.514
1023	0.518
1073	0.522
1123	0.526
1173	0.530
1193	0.532*

* Not shown on plot

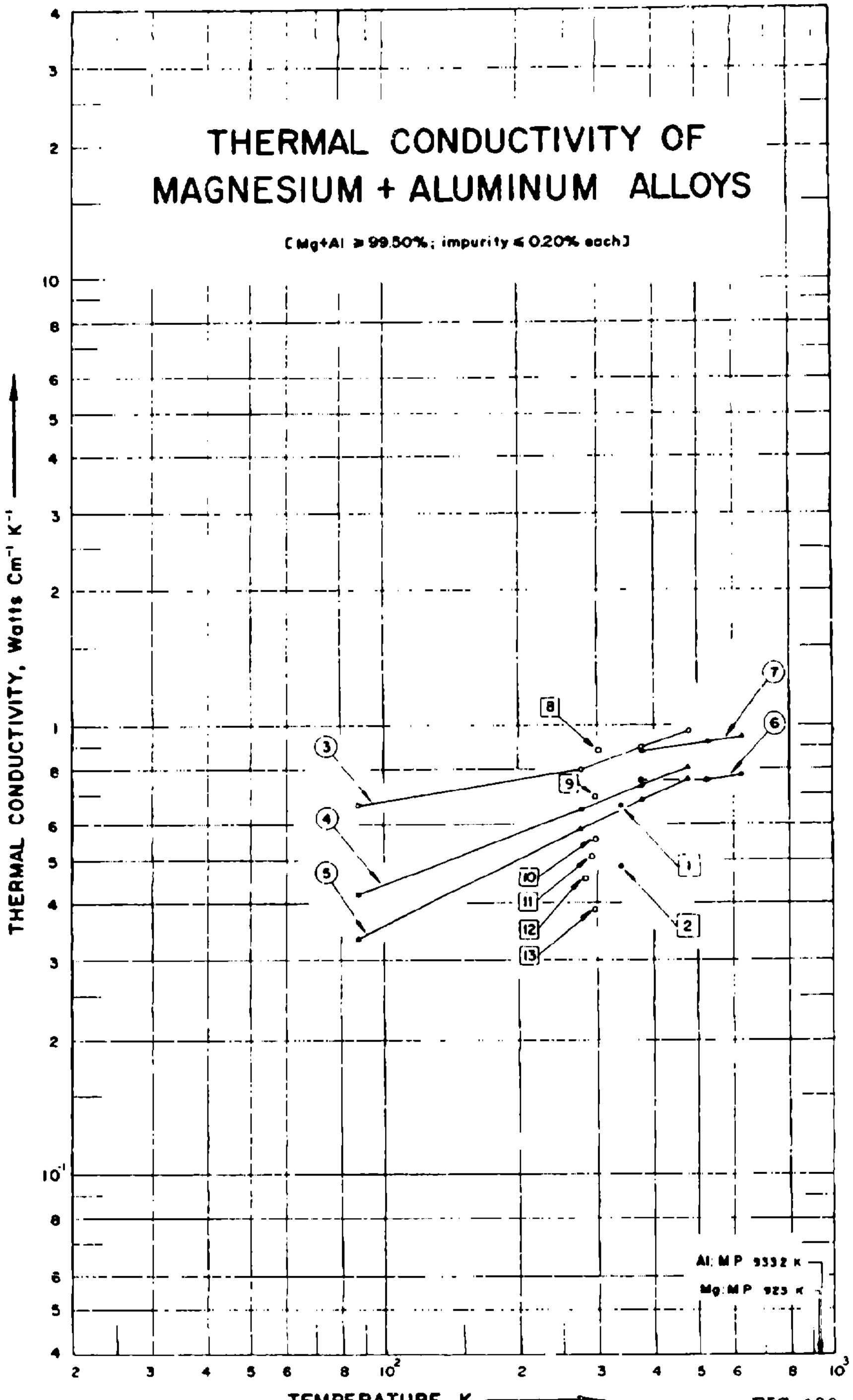

THERMAL CONDUCTIVITY OF
MAGNESIUM + ALUMINUM ALLOYS
[Mg+Al ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Al: M P 933.2 K
Mg: M P 923 K
1
2
3
4
5
6
7
8
9
10
11
12
13

FIG 139

SPECIFICATION TABLE NO. 139 THERMAL CONDUCTIVITY OF [MAGNESIUM + ALUMINUM] ALLOYS

(Mg + Al > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 139]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Al	Composition (continued), Specifications and Remarks
1	230	L	1925	336.2			95.82	4.12	0.028 Fe, 0.019 Si; specimen ~5 cm long with cross-section 0.3 cm^2; supplied by Aluminum Co. of America; electrical conductivity 9.06 x 10^4 ohm^{-1} cm^{-1} at 63 C.
2	230	L	1925	336.2			89.82	10.12	0.023 Si, 0.028 Fe; similar to the above specimen except electrical conductivity 6.00 x 10^4 ohm^{-1} cm^{-1} at 63 C.
3	850, 93	L	1929	87-476	3-4		94.0	6.0	Specimen 1.23 cm^2 in cross section and 3 cm long; cast; electrical conductivity 14.7, 8.04, 6.47 and 5.99 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
4	850, 93	L	1929	87-476	3-4		92.0	8.0	Similar to the above specimen except electrical conductivity 13.32, 7.31, 5.95 and 5.55 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
5	850, 93	L	1929	87-476	3-4		88	12	Similar to the above specimen except electrical conductivity 9.65, 5.99, 5.27 and 4.90 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
6	225	L	1928	373-623			94.0	6	Specimen 12 in. long and 1 in. in dia; annealed at 300 C for 3 hrs.
7	225	L	1928	373-623			89	11	Similar to the above specimen.
8	673	E	1932	300.2	1.3		97.9	2.1	Specimen 200 mm long; electrical conductivity 11.9 x 10^4 ohm^{-1} cm^{-1} at 27 C.
9	673	E	1932	295.5	1.3		95.8	4.2	Specimen 200 mm long; electrical conductivity 8.9 x 10^4 ohm^{-1} cm^{-1} at 22.3 C.
10	673	E	1932	295.1	1.3		93.8	6.2	Specimen 200 mm long; electrical conductivity 6.9 x 10^4 ohm^{-1} cm^{-1} at 21.9 C.
11	673	E	1932	291.5	1.3		91.8	8.2	Specimen 200 mm long; electrical conductivity 5.9 x 10^4 ohm^{-1} cm^{-1} at 18.3 C.
12	673	E	1932	291.5	1.3		89.7	10.3	Specimen 200 mm long; electrical conductivity 5.5 x 10^4 ohm^{-1} cm^{-1} at 19.3 C.
13	673	E	1932	296.5	1.3		87.8	12.2	Specimen 200 mm long; electrical conductivity 5.1 x 10^4 ohm^{-1} cm^{-1} at 23.1 C.

DATA TABLE NO. 139 THERMAL CONDUCTIVITY OF [MAGNESIUM + ALUMINUM] ALLOYS

(Mg + Al $\geq$ 99.50% ; impurity $\leq$ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		**CURVE 8**	
336.0	0.665	300.2	0.887
CURVE 2		**CURVE 9**	
336.0	0.485	295.5	0.690
CURVE 3		**CURVE 10**	
87.0	0.603	295.1	0.556
273.0	0.799	**CURVE 11**	
373.0	0.895	291.5	0.510
476.0	0.971	**CURVE 12**	
CURVE 4		231.5	0.452
87.0	0.419	**CURVE 13**	
273.0	0.649	296.3	0.385
373.0	0.736		
476.0	0.808		
CURVE 5			
87.0	0.335		
2[illegible].0	0.586		
373.0	0.682		
476.0	0.761		
CURVE 6			
373.2	0.753		
523.2	0.753		
623.2	0.774		
CURVE 7			
373.2	0.879		
523.2	0.920		
623.2	0.941		

SPECIFICATION TABLE NO. 110 THERMAL CONDUCTIVITY OF [MAGNESIUM + CADMIUM] ALLOYS

(Mg + Cd ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Cd	Composition (continued), Specifications and Remarks
1	93, 850	L	1929	87–476	3–4		92.0	8.0	Specimen 1.23 cm^2 in corss section and 3 cm long; as cast; electrical conductivity 85.0, 18.43, 14.85 and 11.33 x 10^4 ohm^{-1}cm^{-1} at 87, 273, 373 and 476 K respectively.

DATA TABLE NO. 110 THERMAL CONDUCTIVITY OF [MAGNESIUM + CADMIUM] ALLOYS

(Mg + Cd ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1*	
87.00	1.301
273.00	1.414
373.00	1.477
476.00	1.544

* No graphical presentation

SPECIFICATION TABLE NO. 141 THERMAL CONDUCTIVITY OF (MAGNESIUM + CALCIUM) ALLOYS

(Mg + Ca ≥ 99.5%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Ca	Composition (continued), Specifications and Remarks
1	397	L	1939	323-523	≤3	W 1641	97.11	2.82	0.07 impurities; specimen ~29 cm long and 1.4 cm in dia; forged at elevated temperature; density 1.74 g cm^{-3}; electrical resistivity 4.85, 5.35, 7.05 and 8.7 μohm cm at 20, 50, 150 and 250 C respectively.

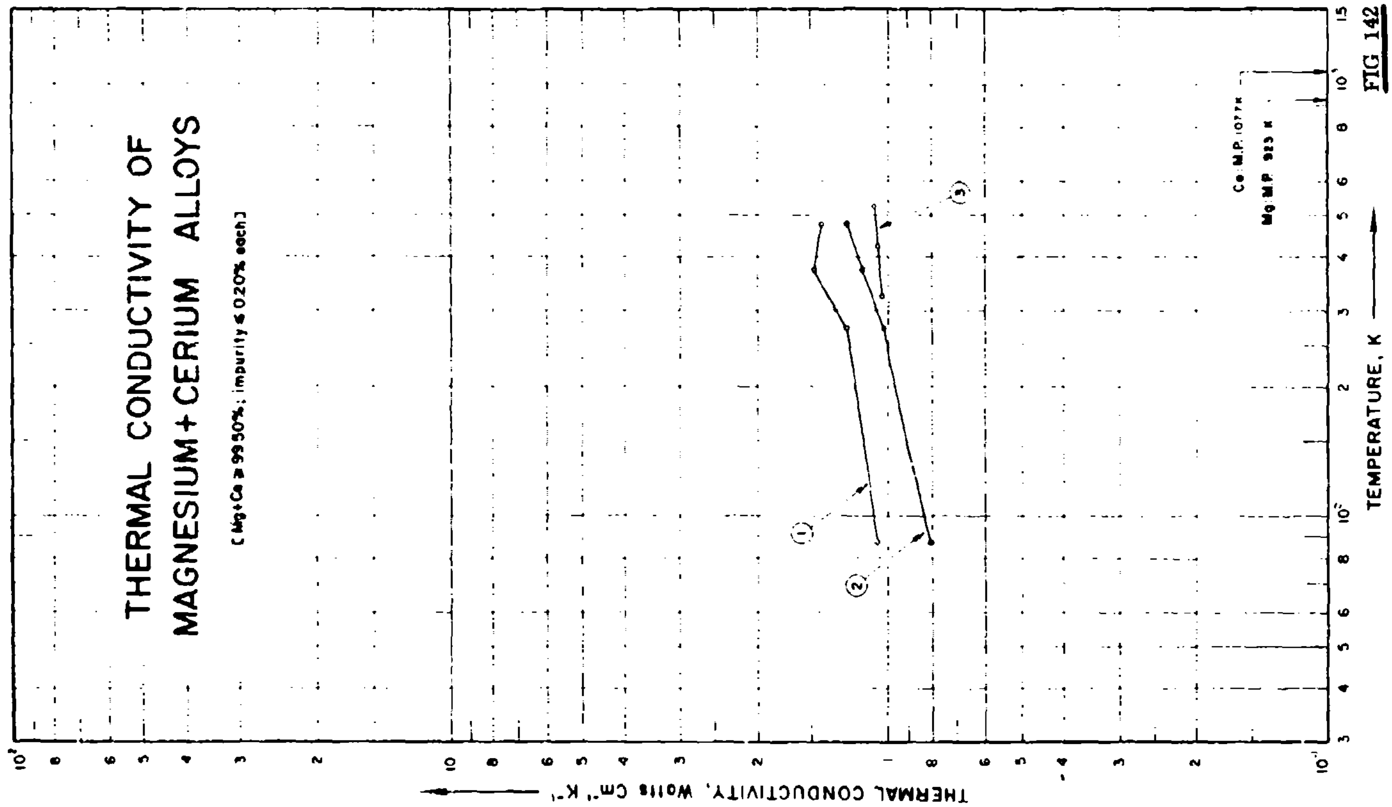
DATA TABLE NO. 141 THERMAL CONDUCTIVITY OF (MAGNESIUM + CALCIUM) ALLOYS

(Mg + Ca ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
323.2	1.402
423.2	1.423
523.2	1.423

* No graphical presentation



THERMAL CONDUCTIVITY OF
MAGNESIUM + CERIUM ALLOYS
[Mg+Ce ≥ 99.50%; impurity ≤ 0.20% each]
Ce: M.P. 1077 K
Mg: M.P. 923 K
THERMAL CONDUCTIVITY, Watts cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 142

SPECIFICATION TABLE NO. 142 THERMAL CONDUCTIVITY OF (MAGNESIUM + CERIUM) ALLOYS

(Mg + Ce > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 142]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Ce	Composition (continued), Specifications and Remarks
1	850, 93	L	1929	87-476	3-4		92.0	8.0	Specimen 1.23 cm^2 in cross section and 3 cm long, as cast; electrical conductivity 74.02, 14.0, 10.07 and 8.22 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
2	850, 93	L	1929	87-476	3-4		88.0	12.0	Similar to the above specimen except electrical conductivity 45.5, 11.5, 8.79 and [illegible].32 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
3	397	L	1939	323-523	< 3	W 1630	89.84	10.1	Specimen ~29 cm long and 1.4 cm in dia; 0.06 impurities; forged at elevated temperature; density 1.86 g cm^{-3}; Ce in the form of mischmetal; electrical resistivity 6.7, 7.4, 9.7, and 11.9 μohm cm at 20, 50, 150 and 250 C, respectively.

DATA TABLE NO. 142 THERMAL CONDUCTIVITY OF [MAGNESIUM + CERIUM] ALLOYS

(Mg + Ce ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
87.0	1.059
273.0	1.251
373.0	1.473
476.0	1.423
CURVE 2	
87.0	0.808
273.0	1.029
373.0	1.159
476.0	1.255
CURVE 3	
323.2	1.046
423.2	1.067
523.2	1.088

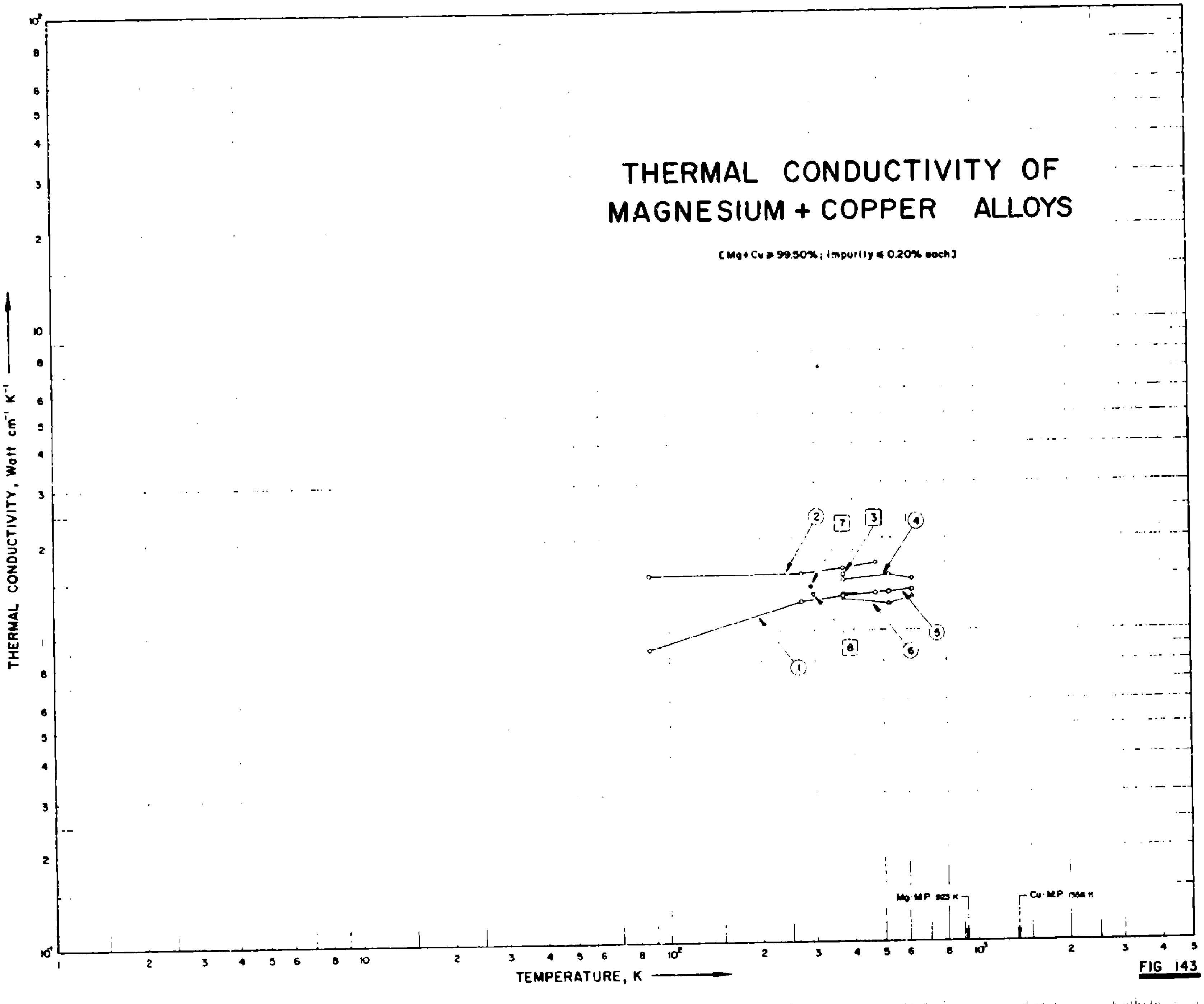

THERMAL CONDUCTIVITY OF
MAGNESIUM + COPPER ALLOYS
[Mg+Cu ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Mg·M.P. 923 K
Cu·M.P. 1356 K

FIG 143

SPECIFICATION TABLE NO. 143 THERMAL CONDUCTIVITY OF MAGNESIUM - COPPER ALLOYS

(Mg + Cu ≥ 99.50%, impurity ≤ 0.20% each)

For Data Reported in Figure and Table No. 143

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Cu	Composition (continued), Specifications and Remarks
1	850 93	L	1929	87-476	3-4		92.0	8.0	Specimen 1.23 cm^2 in cross-section and 3 cm long; cast; electrical conductivity 43.0, 17.57, 14.95 and 10.7 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
2	850 93	L	1929	87-476	3-4		85.0	15.0	Similar to the above specimen except electrical conductivity 92.6, 20.6, 17.5 and 12.5 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
3	53	E	1927	373	1.0		96.0	4.0	Forged.
4	225	L	1928	373-623			97.0	3.0	Specimen 12 in. long and 1 in. in dia; annealed at 300 C for 3 hrs.
5	225	L	1928	373-623			8[illegible].0	13.0	Similar to the above specimen.
6	225	L	1928	373-623			91.0	1.0	Similar to the above specimen.
7	673	E	1932	293.5	1.3		97.6	2.4	Specimen 200 mm long; electrical conductivity 22.0 x 10^4 ohm^{-1} cm^{-1} at 20.3 C.
8	673	E	1932	297.4	1.3		93.7	6.3	Specimen 200 mm long; electrical conductivity 20.8 x 10^4 ohm^{-1} cm^{-1} at 24.2 C.

DATA TABLE NO. 143 THERMAL CONDUCTIVITY OF (MAGNESIUM + COPPER) ALLOYS

(Mg + Cu ≥ 99.50%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
87	0.879
273	1.247
373	1.297
476	1.326
CURVE 2	
87	1.506
273	1.544
373	1.590
476	1.653
CURVE 3	
373	1.506
CURVE 4	
373.2	1.464
523.2	1.506
623.2	1.464
CURVE 5	
373.2	1.297
523.2	1.339
623.2	1.360
CURVE 6	
373.2	1.276
523.2	1.234
623.2	1.297
CURVE 7	
293.5	1.389
CURVE 8	
297.4	1.310

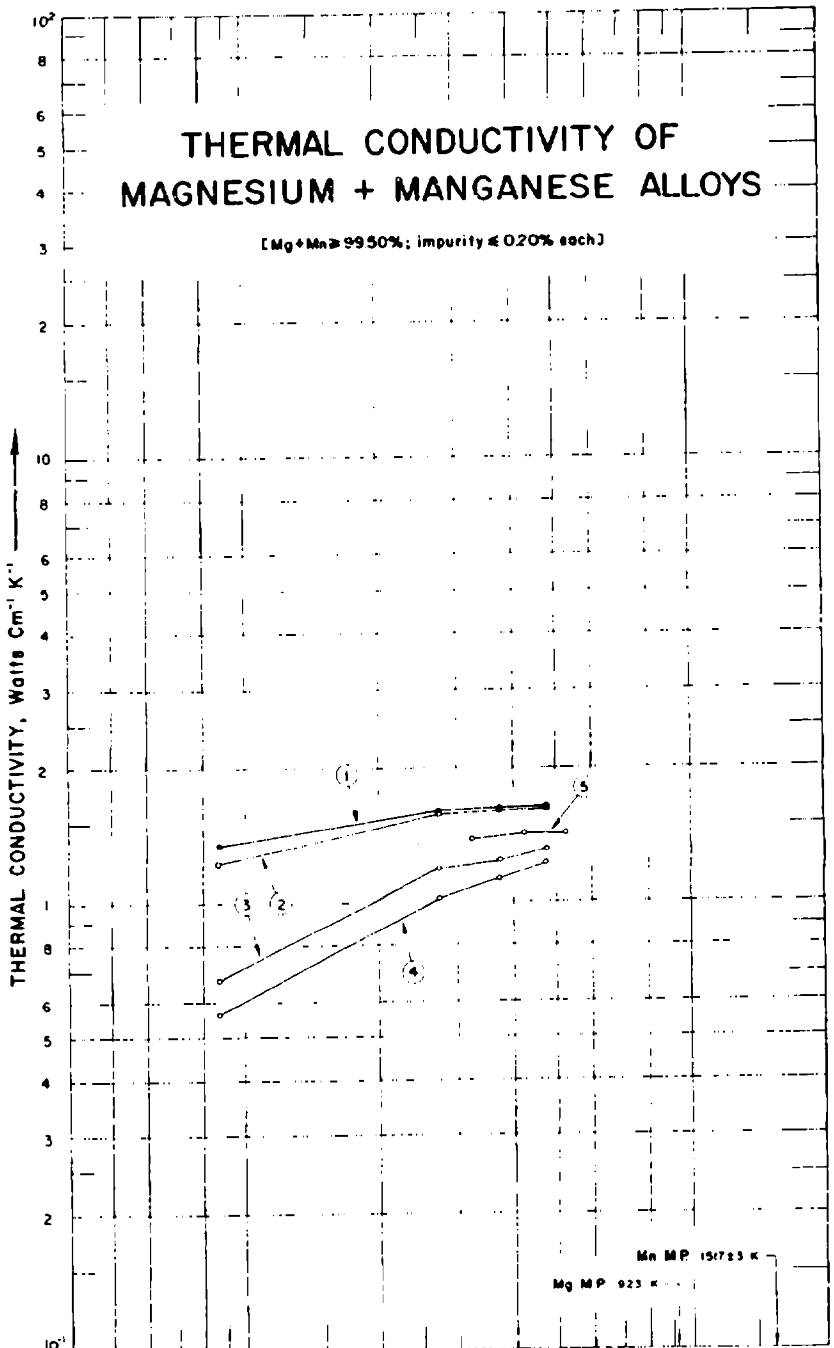

THERMAL CONDUCTIVITY OF
MAGNESIUM + MANGANESE ALLOYS
[Mg+Mn ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Mn M.P. 1517±3 K
Mg M.P. 923 K
1
2
3
4
5

FIG 144

SPECIFICATION TABLE NO. 144 THERMAL CONDUCTIVITY OF [MAGNESIUM + MANGANESE] ALLOYS

(Mg + Mn > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 144]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Mn	Composition (continued), Specifications and Remarks
1	850, 93	L	1929	87-476	3-4		99.5	0.5	Specimen 1.23 cm^2 in cross-section and 3 cm long; cast; electrical conductivity 93.90, 19.05, 13.26 and 10.6 x 10^4 $ohm^{-1}cm^{-1}$ at 87, 273, 373 and 476 K, respectively.
2	850, 93	L	1929	87-476	3-4		99.2	0.8	Specimen 1.23 cm^2 in cross-section and 3 cm long; cast; electrical conductivity 64.46, 17.88, 12.30 and 10.0 x 10^4 $ohm^{-1}cm^{-1}$ at 87, 273, 373 and 476 K, respectively.
3	850, 93	L	1929	87-476	3-4		98.0	2.0	Similar to the above specimen except electrical conductivity 38.50, 14.37, 11.0 and 8.70 x 10^4 $ohm^{-1}cm^{-1}$ at 87, 273, 373 and 476 K, respectively.
4	850, 93	L	1929	87-476	3-4		96.46	3.54	Similar to the above specimen except electrical conductivity 29.5, 12.66, 9.8 and 8.0 x 10^4 $ohm^{-1}cm^{-1}$ at 87, 273, 373 and 476 K, respectively.
5	397	L	1939	323-523	< 3.0	W 1567	97.29	2.64	0.07 total impurities; specimen 29 cm long and 1.4 cm in dia; forged at elevated temperature; density 1.77 g cm^{-3}; electrical resistivity 4.9, 5.4, 7.15 and 8.9 μohm cm at 20, 50, 150 and 250 C, respectively.

DATA TABLE NO. 144 THERMAL CONDUCTIVITY OF [MAGNESIUM + MANGANESE] ALLOYS

(Mg + Mn > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
87	1.339
273	1.598
373	1.632
476	1.644
CURVE 2	
87	1.222
273	1.577
373	1.603
476	1.615
CURVE 3	
87	0.674
273	1.176
373	1.243
476	1.310
CURVE 4	
87	0.565
273	1.021
373	1.130
476	1.234
CURVE 5	
323.2	1.381
423.2	1.423
523.2	1.423

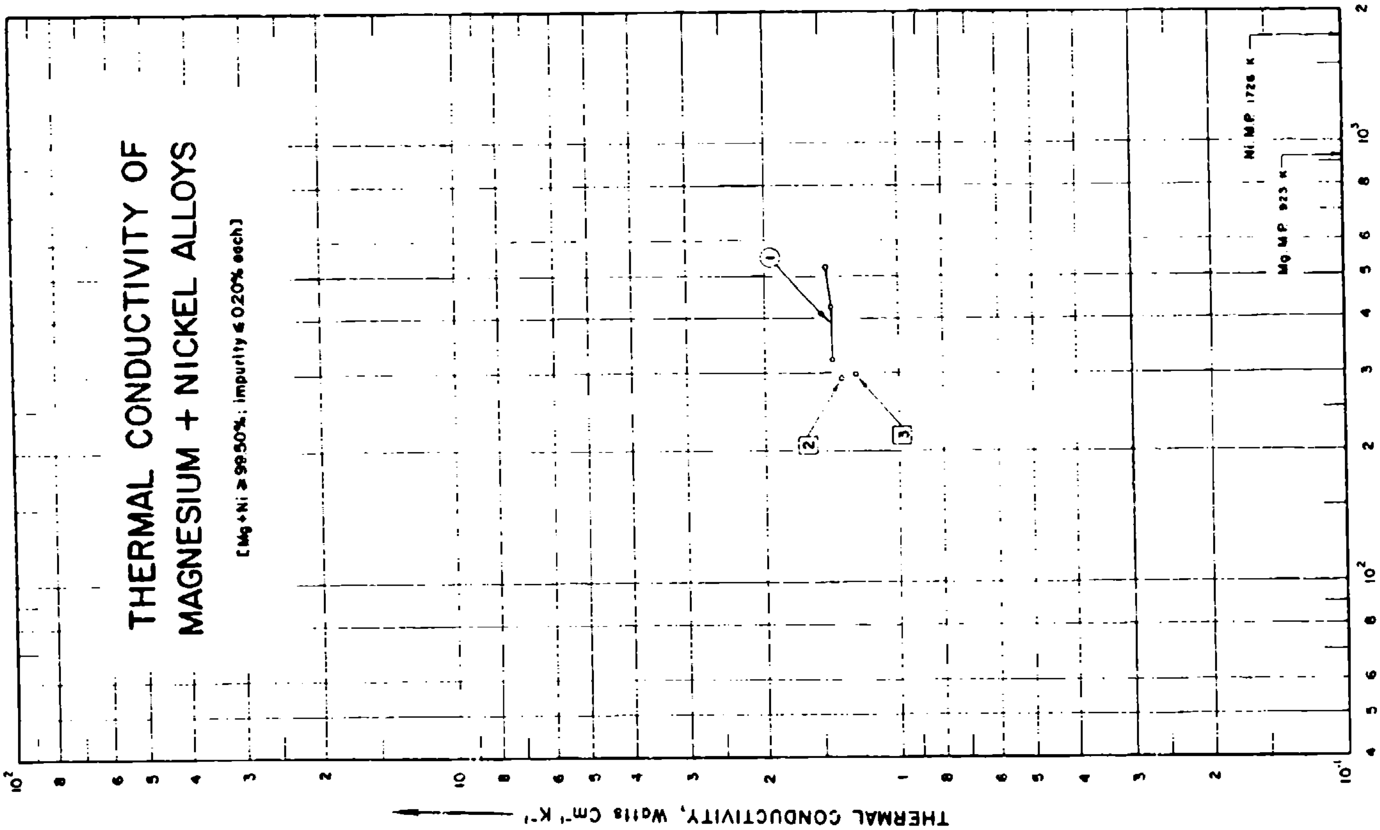

THERMAL CONDUCTIVITY OF
MAGNESIUM + NICKEL ALLOYS
[Mg + Ni ≥ 99.50%; impurity ≤ 0.20% each]
Ni M.P. 1726 K
Mg M.P. 923 K
1
2
3
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 145

SPECIFICATION TABLE NO. 145 THERMAL CONDUCTIVITY OF [MAGNESIUM + NICKEL] ALLOYS

(Mg + Ni ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 145]

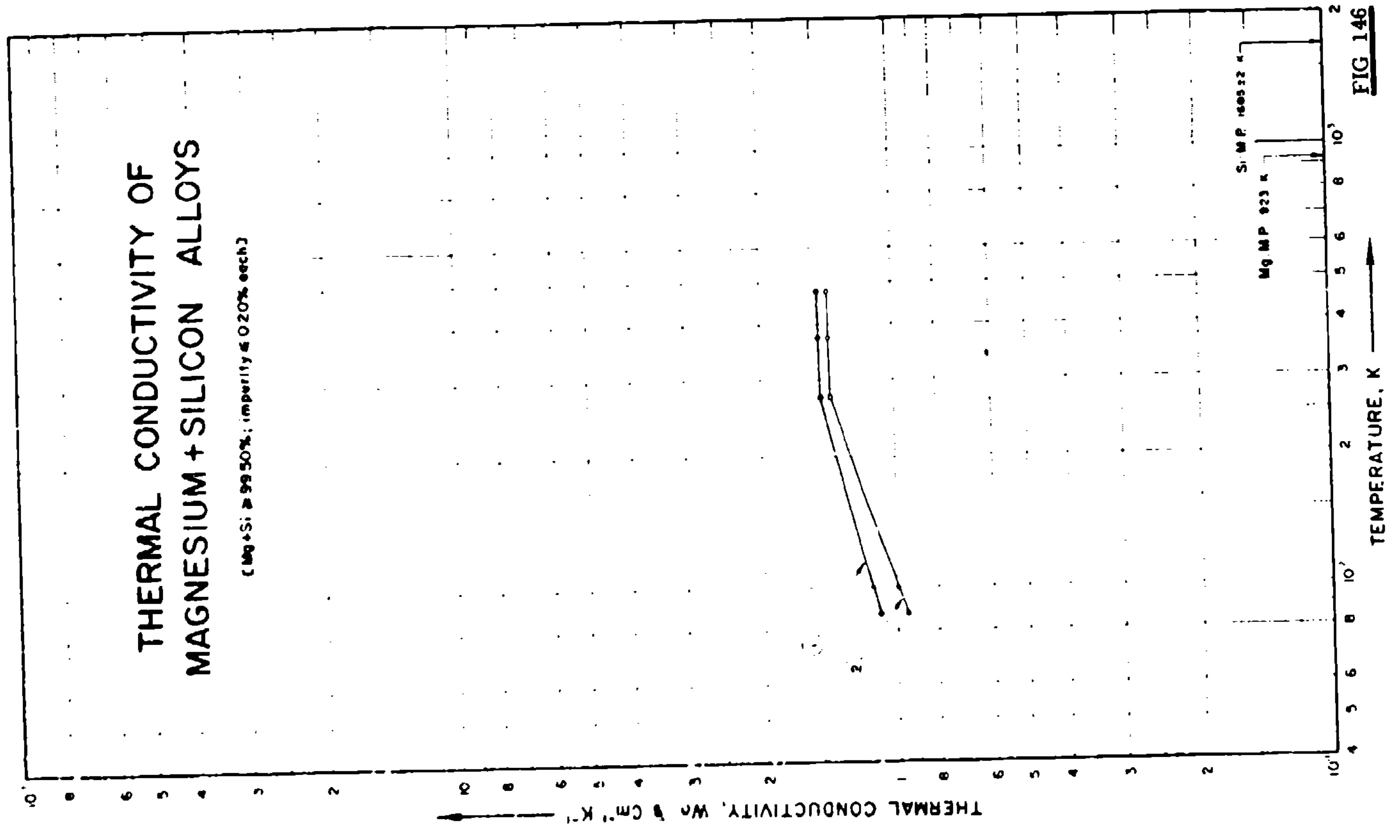
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Ni	Composition (continued), Specifications and Remarks
1	397	L	1939	323-523	±3.0	W 1635	94.37	5.56	0.07 impurities; specimen ~29 cm long and 1.4 cm in dia; density 1.84 g cm^{-3}; electrical resistivity 4.7, 5.2, 7.0, and 8.75 μohm cm at 20, 50, 150 and 250 C, respectively.
2	673	E	1932	293.4	1.3		98.1	1.9	Specimen 200 mm long; electrical conductivity 21.4×10^4 ohm^{-1} cm^{-1} at 20.2 C.
3	673	E	1932	297.7	1.3		94.2	5.8	Specimen 200 mm long; electrical conductivity 20.3×10^4 ohm^{-1} cm^{-1} at 24.5 C.

DATA TABLE NO. [illegible] THERMAL CONDUCTIVITY OF [MAGNESIUM + NICKEL] ALLOYS

[Mg + Ni (95.50%), impurity < 0.20% each]

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
323.2	1.42
423.2	1.42
523.2	1.40
CURVE 2	
293.4	1.36
CURVE 3	
297.7	1.26



THERMAL CONDUCTIVITY OF
MAGNESIUM + SILICON ALLOYS
(Mg+Si ≥ 99.50%; impurity ≤ 0.20% each)
Si M.P. 1685±2 K
Mg M.P. 923 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}

FIG 146

SPECIFICATION TABLE NO. 146 THERMAL CONDUCTIVITY OF [MAGNESIUM + SILICON] ALLOYS

(Mg + Si ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 146]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Si	Composition (continued), Specifications and Remarks
1	450, 93	L	1929	87-476	3-4		99.3	0.7	Specimen 1.23 cm^2 in cross-section and 3 cm long; cast; electrical conductivity 113.0, 18.76, 12.96 and 10.04 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
2	450, 93	L	1929	87-476	3-4		98.5	1.5	Similar to the above specimen except electrical conductivity 108.0, 17.37, 11.72 and 8.93 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.

DATA TABLE NO. 146 THERMAL CONDUCTIVITY OF [MAGNESIUM + SILICON] ALLOYS

(Mg + Si ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
87	1.096
273	1.473
373	1.482
476	1.486
CURVE 2	
87	0.950
273	1.397
373	1.402
476	1.406

SPECIFICATION TABLE NO. 147 THERMAL CONDUCTIVITY OF (MAGNESIUM + SILVER) ALLOYS

(Mg + Ag > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Ag	Composition (continued), Specifications and Remarks
1	673	E	1932	298.7	1.5		97.8	2.2	Specimen 200 mm long; electrical conductivity 19.2 x 10^4 $ohm^{-1}cm^{-1}$ at 25.5 C.
2	673	E	1932	300.2	1.3		94.0	6.0	Specimen 200 mm long; electrical conductivity 17.3 x 10^4 $ohm^{-1}cm^{-1}$ at 27 C.

DATA TABLE NO. 147 THERMAL CONDUCTIVITY OF (MAGNESIUM + SILVER) ALLOYS

(Mg + Ag > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.7	1.310
CURVE 2*	
300.2	1.155

* No graphical presentation

SPECIFICATION TABLE NO. 148 THERMAL CONDUCTIVITY OF (MAGNESIUM + TIN) ALLOYS

(Mg + Sn $\geq$ 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Sn	Composition (continued), Specifications and Remarks
1	673	E	1932	294.2	1.3		97.8	2.2	Specimen 200 mm long; electrical conductivity 15.6 x 10^4 $ohm^{-1}cm^{-1}$ at 21 C.
2	673	E	1932	294.7	1.3		93.6	6.4	Specimen 200 mm long; electrical conductivity 10.2 x 10^4 $ohm^{-1}cm^{-1}$ at 21.5 C.

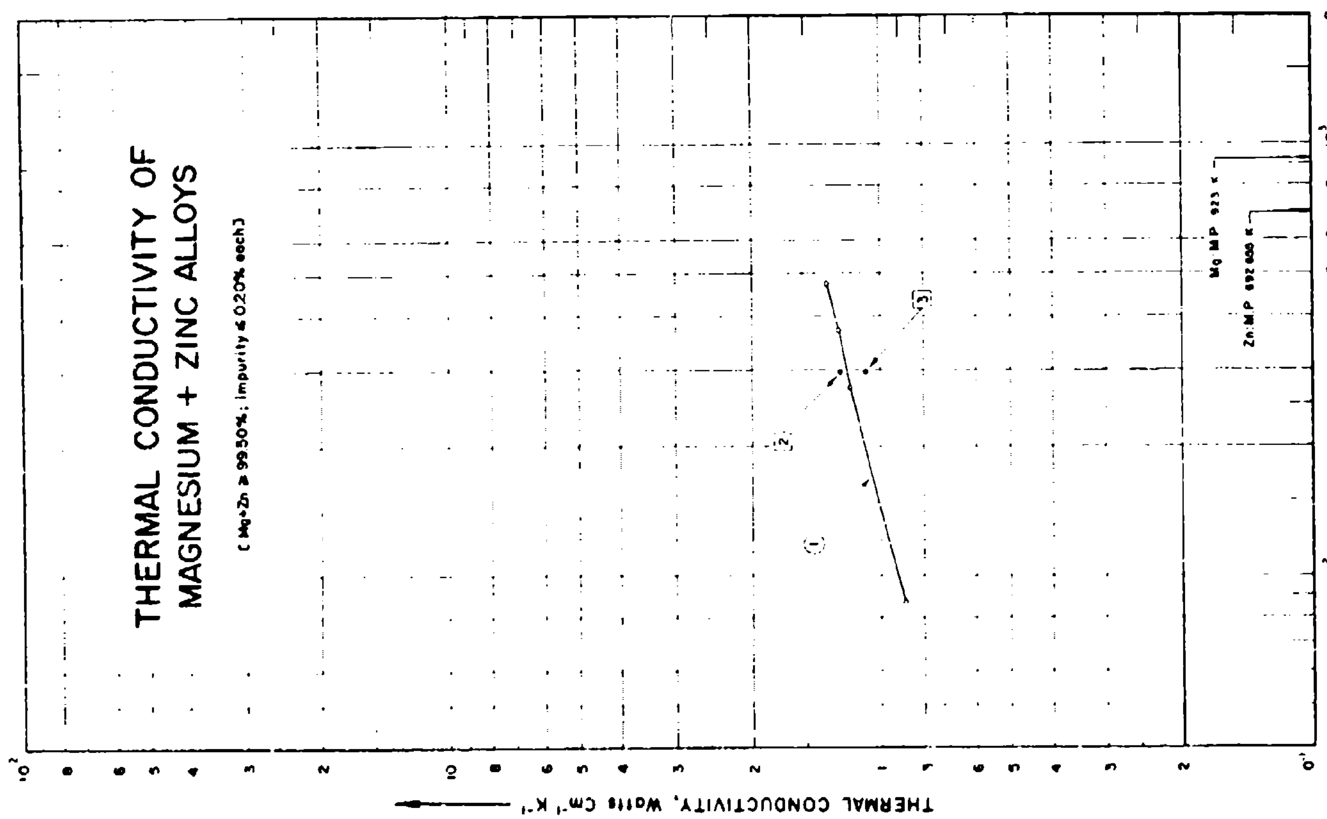
DATA TABLE NO. 148 THERMAL CONDUCTIVITY OF (MAGNESIUM + TIN) ALLOYS

(Mg + Sn $\geq$ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
294.2	1.059
CURVE 2*	
294.7	0.741

* No graphical presentation



THERMAL CONDUCTIVITY OF MAGNESIUM + ZINC ALLOYS
(Mg+Zn ≥ 99.50%; Impurity ≤ 0.20% each)
Mg M.P. 923 K
Zn M.P. 692.655 K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 149

SPECIFICATION TABLE NO. 149 THERMAL CONDUCTIVITY OF [MAGNESIUM + ZINC] ALLOYS

(Mg + Zn ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 149]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Zn	Composition (continued), Specifications and Remarks
1	530, 93	L	1929	87-476	3-4		92.0	8.0	Specimen 1.23 cm^2 in cross-section and 3 cm long; electrical conductivity 34.0, 15.37, 11.50 and 8.50 x 10^4 $ohm^{-1} cm^{-1}$ at 87, 273, 373 and 476 K, respectively.
2	673	E	1932	299.0	1.3		97.9	2.1	Specimen 200 mm long; electrical conductivity 18.7 x 10^4 $ohm^{-1} cm^{-1}$ at 25.8 C.
3	673	E	1932	298.7	1.3		93.9	6.1	Specimen 200 mm long; electrical conductivity 16.6 x 10^4 $ohm^{-1} cm^{-1}$ at 25.5 C.

DATA TABLE NO. 149 THERMAL CONDUCTIVITY OF [MAGNESIUM + ZINC] ALLOYS

(Mg + Zn ≥99.50%; impurity ≤0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
87	0.887
273	1.19
373	1.27
476	1.35
CURVE 2	
299	1.26
CURVE 3	
299.7	1.09

SPECIFICATION TABLE NO. 150 THERMAL CONDUCTIVITY OF [MANGANESE + COPPER] ALLOYS

(Mn + Cu > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mn	Cu	Composition (continued), Specifications and Remarks
1	230	L	1925	332.2			60.0	40.0	Approx composition; the alloy made from Cu (< 0.03 impurity) supplied by Baker and fused with Mn, supplied by Eimer and Amend; specimen ~5 cm long with 0.3 cm² in cross-section; electrical conductivity 0.82×10^4 $ohm^{-1} cm^{-1}$ at 23 C.
2	230	L	1925	332.2			80.0	20.0	Similar to the above specimen except electrical conductivity 0.687×10^4 $ohm^{-1} cm^{-1}$ at 23 C.

DATA TABLE NO. 150 THERMAL CONDUCTIVITY OF [MANGANESE + COPPER] ALLOYS

(Mn + Cu > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
332.2	0.113
CURVE 2*	
332.2	0.105

* No graphical presentation

SPECIFICATION TABLE NO. 151 THERMAL CONDUCTIVITY OF [MANGANESE + IRON] ALLOYS

(Mn + Fe > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mn	Fe	Composition (continued), Specifications and Remarks
1	204	L	1937	317.8		Ferromanganese, 23	86.79	13.21	No detail reported.

DATA TABLE NO. 151 THERMAL CONDUCTIVITY OF [MANGANESE + IRON] ALLOYS

(Mn + Fe > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1*	
317.8	0.715

* No graphical presentation

SPECIFICATION TABLE NO. 152 THERMAL CONDUCTIVITY OF (MANGANESE + NICKEL) ALLOYS

(Mn + Ni $\geq$ 99.50%; impurity $\leq$ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mn	Ni	Composition (continued), Specifications and Remarks
1	230	L	1925	333.2			50	50	Approx composition: specimen made from Ni (99.75 to 99.85 pure including cobalt) supplied by International Nickel Co. of America and fused with Mn, supplied by Eimer and Amend; specimen ~5 cm long with 0.3 cm^2 in cross-section; electrical conductivity 3.56 x 10^3 $ohm^{-1}cm^{-1}$ at 25 C.
2	230	L	1925	333.2			60	40	Similar to the above specimen except electrical conductivity 4.59 x 10^3 $ohm^{-1}cm^{-1}$ at 25 C.
3	230	L	1925	333.2			70	30	Similar to the above specimen except electrical conductivity 5.12 x 10^3 $ohm^{-1}cm^{-1}$ at 25C.
4	230	L	1925	333.2			90	10	Similar to the above specimen except electrical conductivity 5.58 x 10^3 $ohm^{-1}cm^{-1}$ at 25 C.

DATA TABLE NO. 152 THERMAL CONDUCTIVITY OF (MANGANESE + NICKEL) ALLOYS

(Mn + Ni $\geq$ 99.50%; impurity $\leq$ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1[a]		CURVE 4[a]	
333.2	0.092	333.2	0.092
CURVE 2[a]			
333.2	0.096		
CURVE 3[a]			
333.2	0.105		

[a] No graphical presentation

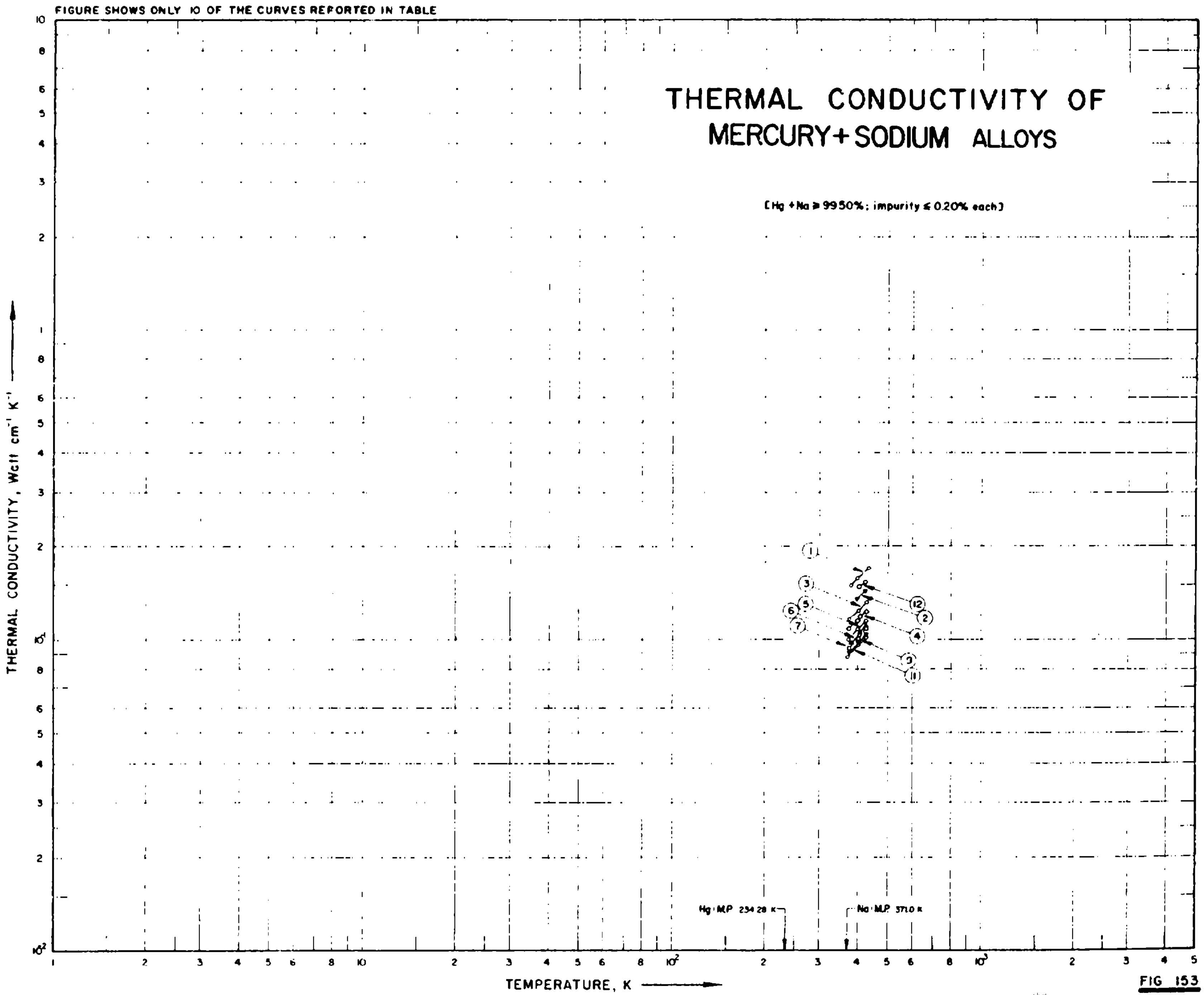


FIGURE SHOWS ONLY 10 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
MERCURY+SODIUM ALLOYS
[Hg + Na ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Hg: M.P. 234.28 K
Na: M.P. 371.0 K

FIG 153

SPECIFICATION TABLE NO. 153 THERMAL CONDUCTIVITY OF MERCURY + SODIUM ALLOYS

(Hg + Na ≥ 99.50%; impurity ≤ 0.50%)

(For Data Reported in Figure and Table No. 153)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Hg	Na	Composition (continued), Specifications and Remarks
1	316, 65	L	1936	380-433	3.0	18	53.37	46.63	Molten specimen contained in a cylinder; prepared by melting under paraffin the appropriate amount of certified pure Hg from Mallinckrodt Chemical Co. and Na from Chemistry Dept. of Univ. of Kansas.
2	316, 65	L	1936	397-423	3.0	16	58.05	41.95	Similar to the above specimen.
3	316, 65	L	1936	376-429	3.0	15	62.60	37.40	Similar to the above specimen.
4	316, 65	L	1936	375-429	<3.0	14	65.54	34.46	Similar to the above specimen.
5	316, 65	L	1936	374-426	<3.0	12	68.56	31.44	Similar to the above specimen.
6	316, 65	L	1936	379-426	<3.0	10	71.57	28.43	Similar to the above specimen.
7	316, 65	L	1936	375-427	<3.0	9	73.26	26.74	Similar to the above specimen.
8	316, 65	L	1936	376-427	<3.0	8	74.30	25.70	Similar to the above specimen.
9	316, 65	L	1936	376-424	<3.0	6	76.15	23.85	Similar to the above specimen.
10	316, 65	L	1936	373-424	<3.0	5	77.75	22.25	Similar to the above specimen.
11	316, 65	L	1936	371-421	<3.0	4	78.89	21.11	Similar to the above specimen.
12	316, 65	L	1936	405-425	<3.0	17	56.8	43.2	Similar to the above specimen.
13	316, 65	L	1936	377-430	<3.0	13	68.0	32.0	Similar to the above specimen.
14	316, 65	L	1936	378-425	<3.0	11	69.7	30.3	Similar to the above specimen.
15	316, 65	L	1936	377-423	<3.0	7	75.6	24.4	Similar to the above specimen.

SPECIFICATION TABLE NO. 153 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Hg	Na	Composition (continued), Specifications and Remarks
16	316	L	1936	372-403	< 3.0	3	98.71	1.29	Similar to the above specimen.
17	316	L	1936	380-410	< 3.0	2	99.767	0.233	Similar to the above specimen.

DATA TABLE NO. 153 THERMAL CONDUCTIVITY OF [MERCURY + SODIUM] ALLOYS

(Hg + Na ≥ 99.50%; Impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

CURVE 1

T	k
330.4	0.149
398.8	0.157
433.7	0.170

CURVE 2

T	k
397.2	0.135
423.3	0.144

CURVE 3

T	k
376.4	0.116
401.7	0.124
429.0	0.132

CURVE 4

T	k
375.4	0.108
399.0	0.115
409.3	0.118
429.4	0.122

CURVE 5

T	k
374.4	0.0999
399.5	0.107
426.4	0.115

CURVE 6

T	k
378.7	0.0975
379.2	0.0978
405.0	0.106
426.4	0.111

CURVE 7

T	k
374.8	0.0940
400.4	0.101
426.9	0.109

CURVE 8*

T	k
375.8	0.0928
400.0	0.0998
427.3	0.107

CURVE 9

T	k
375.9	0.0911
400.4	0.0977
424.4	0.104

CURVE 10*

T	k
373.4	0.0910
399.0	0.0972
400.3	0.0972
421.8	0.103
423.7	0.104

CURVE 11

T	k
370.6	0.0879
400.8	0.0967
420.8	0.102

CURVE 12

T	k
405.0	0.1474
4[illegible]4.[illegible]	0.1537

CURVE 13*

T	k
376.9	0.1030
399.1	0.1101
430.1	0.1186

CURVE 14*

T	k
37[illegible]	0.0995
400.[illegible]	0.1058
425.2	0.1126

CURVE 15*

T	k
377.0	0.0929
400.9	0.0990
422.6	0.1052

CURVE 16*

T	k
372.3	0.1046
401.5	0.1110
402.5	0.1115

CURVE 17*

T	k
379.5	0.1063
403.5	0.1111
409.7	0.1131

* Not shown on plot

SPECIFICATION TABLE NO. 154 THERMAL CONDUCTIVITY OF (MOLYBDENUM + IRON) ALLOYS

(Mo + Fe ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mo	Fe	Composition (continued), Specifications and Remarks
1	204	L	1937	330.4		Russian ferromolybdenum	62	Bal	0.1 C; specimen 20 x 20 mm cross sectional area.

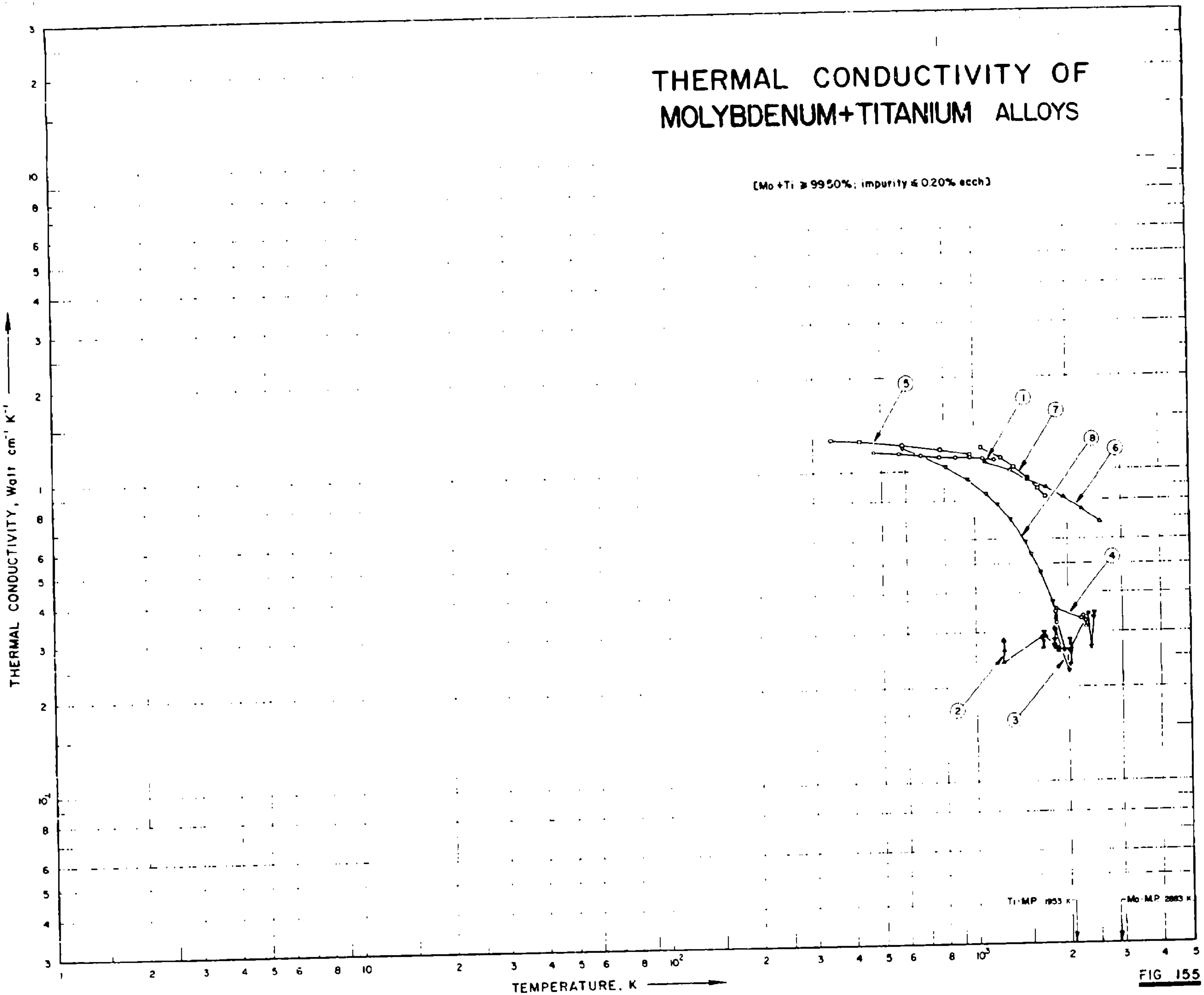
DATA TABLE NO. 154 THERMAL CONDUCTIVITY OF (MOLYBDENUM + IRON) ALLOYS

(Mo + Fe ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
330.4	0.578

* No graphical presentation



THERMAL CONDUCTIVITY OF
MOLYBDENUM+TITANIUM ALLOYS
[Mo+Ti ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ti M.P. 1953 K
Mo M.P. 2883 K
1
2
3
4
5
6
7
8

FIG 155

SPECIFICATION TABLE NO. 155 THERMAL CONDUCTIVITY OF [MOLYBDENUM + TITANIUM] ALLOYS

(Mo + Ti ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 155]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mo	Ti	Composition (continued), Specifications and Remarks
1	543	C	1955	473-1173	5	Heat No. 1132	99.5	0.5	Recrystallized at 2700 F; measured in a vacuum of 2×10^{-6} mm Hg.
2	544	R	1963	1233-1863	~6	1	99.5	0.5	Specimen 3/4 in. long, 3/4 in. O.D., 1/4 in. I.D.; surface scratches eliminated.
3	544	R	1963	1660-2432	~6	1	99.5	0.5	The above specimen remeasured; partially melted after measurement.
4	544	R	1963	1800-2287	~6		99.5	0.5	Specimen 3 in. long, 2.5 in. O.D., 3/4 in. I.D.; surface scratches eliminated; discolored during measurement.
5	583	C	1963	344-975	±4		99.51	0.49	Impurities: 0.026 C, < 0.001 Fe, < 0.0001 Ni, < 0.001 Si, 0.07 Zr, 0.0007 O_2, 0.0001 H_2, and 0.0001 N_2; specimen 2 in. dia, 1 in. thick; supplied by Climax Molybdenum; density 622 lb ft^{-3}; measured in a He atmosphere; Armco iron used as standard.
6	583	P	1963	1100-2578	±4		99.51	0.49	The above specimen measured using different method.
7	815	P	1965	1057-1707		Specimen 2	Bal.	0.28	0.18 Zr, commercial Mo; cylindrical specimen 15 mm in dia and 70 mm long; density 10.17 g cm^{-3}; electrical resistivity 6.52 μohm cm at 23 C; thermal conductivity data obtained from the smooth curve calculated from measurements of thermal diffusivity, specific heat and density.
8	924	R	1961	589-1947			99.5	0.5	Specimen composed of 15 rings, 3 of which were 1 in. thick and 12 were 0.5 in. thick; measured in helium atmosphere; data extracted from the smooth curve.

DATA TABLE NO. 155 THERMAL CONDUCTIVITY OF [MOLYBDENUM + TITANIUM] ALLOYS

(Mo + Ti > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

CURVE 1

T	k
473.2	1.15
573.2	1.14
673.2	1.12
773.2	1.10
873.2	1.10
973.2	1.10
1073.2	1.09
1173.2	1.08

CURVE 2

T	k
1233.2	0.281
1233.2	0.284
1241.5	0.261
1241.5	0.238
1645.9	0.288
1652.1	0.267
1668.7	0.290
1859.3	0.266
1860.4	0.262
1863.2	0.258

CURVE 3

T	k
1659.8	0.297
1659.8	0.293*
1659.8	0.295*
1798.2	0.270
1799.8	0.266
1800.9	0.282
1814.8	0.304
2008.2	0.224
2020.4	0.261
2025.9	0.283
2030.4	0.258
2032.6	0.234
2035.9	0.263
2328.7	0.341
2379.8	0.266
2405.9	0.233
2431.5	0.345

CURVE 4

T	k
1799.8	0.307
1825.9	0.349
1828.7	0.322
1837.1	0.356
2205.4	0.332
2244.3	0.338
2277.6	0.327
2286.5	0.312

CURVE 5

T	k
344.3	1.27
427.6	1.25
588.7	1.21
780.4	1.17
974.8	1.11

CURVE 6

T	k
1099.8	1.07
1319.3	1.00
1494.3	0.935
1702.6	0.883
1958.2	0.815
2238.7	0.746
2577.6	0.678

CURVE 7

T	k
1057	1.188
1220	1.095
1349	1.018
1500	0.941
1609	0.878
1707	0.821

CURVE 8

T	k
588.7	1.19
810.4	1.03
947.6	0.938
1098	0.838
1189	0.774
1316	0.689
1465	0.587
1539	0.537
1647	0.466
1780	0.372
1947	0.260

* Not shown on plot

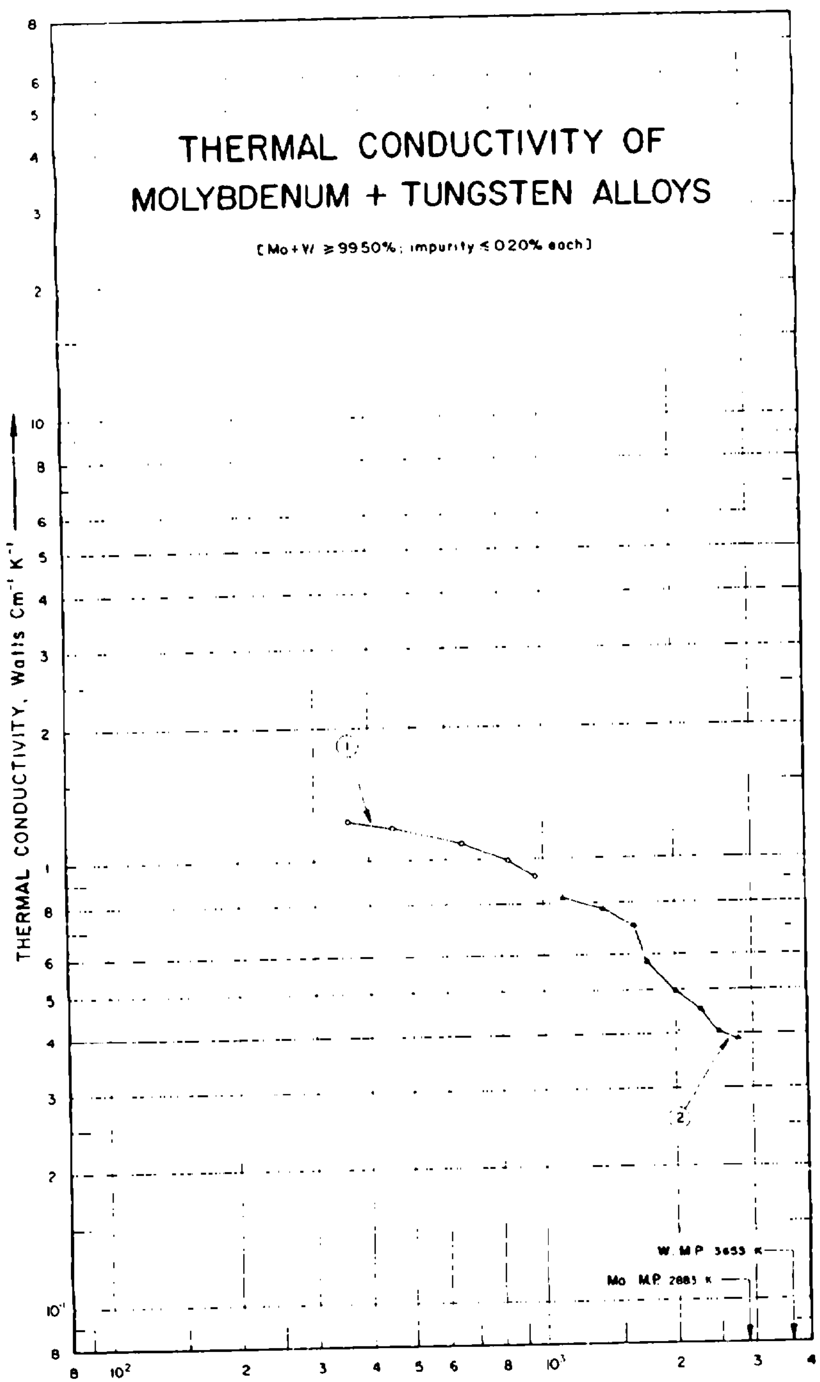

THERMAL CONDUCTIVITY OF
MOLYBDENUM + TUNGSTEN ALLOYS
[Mo+W ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
W MP 3653 K
Mo MP 2883 K
1
2

FIG 156

SPECIFICATION TABLE NO. 156 THERMAL CONDUCTIVITY OF [MOLYBDENUM + TUNGSTEN] ALLOYS

(Mo + W > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 156]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mo	W	Composition (continued), Specifications and Remarks
1	583	C	1963	358-964	±4		70.17	29.83	Impurities: 0.07 Zr and 0.012 C; specimen 2 in. dia, 1 in. thick, supplied by Climax Molybdenum, density 9.93 g cm⁻³; measured in a He atmosphere; Armco iron used as standard.
2	583	P	1963	1110-2772	±4		70.17	29.83	The above specimen measured using different method.

DATA TABLE NO. 156 THERMAL CONDUCTIVITY OF [MOLYBDENUM + TUNGSTEN] ALLOYS

(Mo + W ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
358.1	1.23
452.6	1.19
652.6	1.09
838.7	0.993
963.7	0.919
CURVE 2	
1110.9	0.820
1376.5	0.775
1613.7	0.704
1732.1	0.575
2016.5	0.497
2291.5	0.452
2519.3	0.405
2772.1	0.389

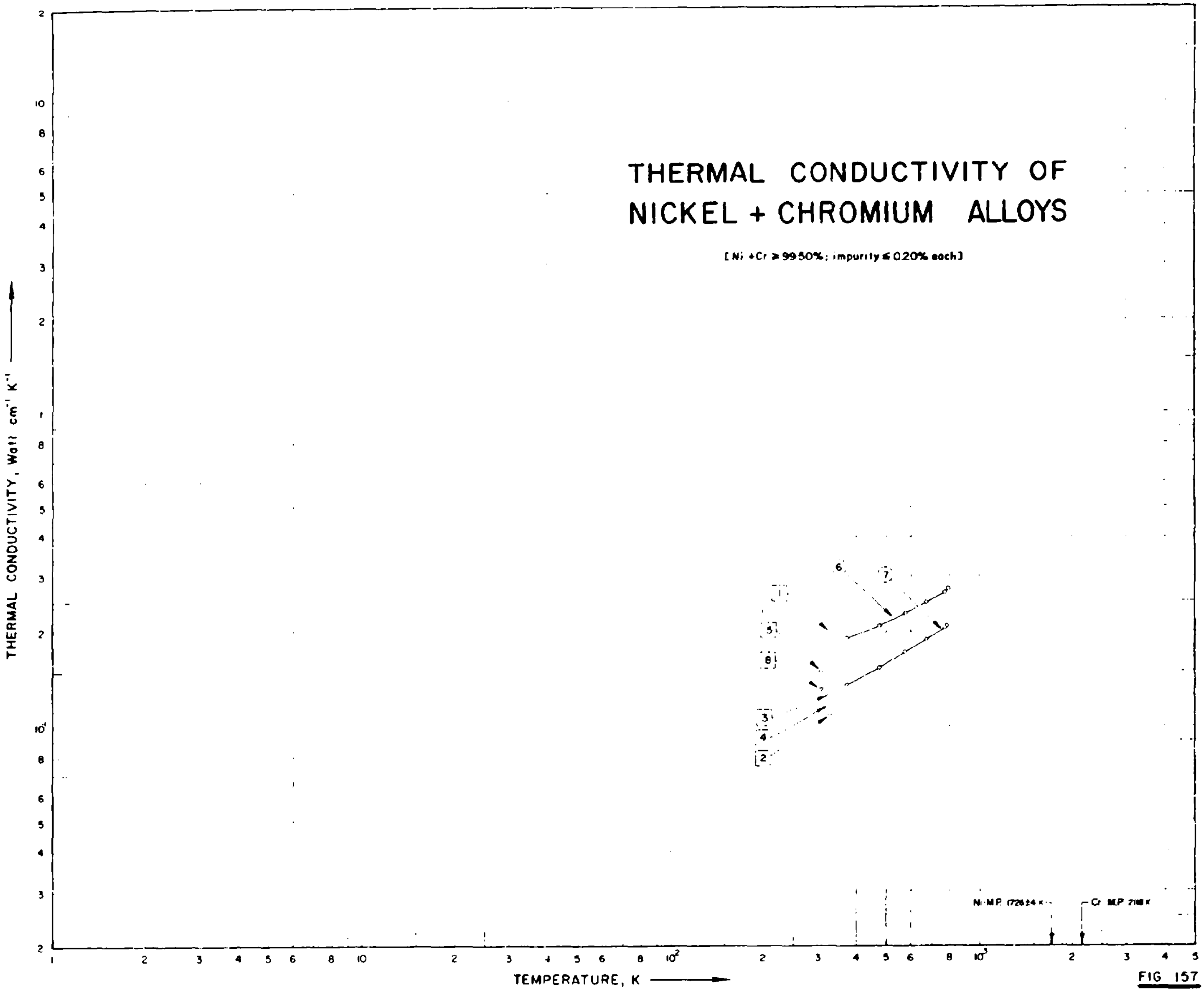

THERMAL CONDUCTIVITY OF
NICKEL + CHROMIUM ALLOYS
[Ni + Cr ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ni M.P. 1728.24 K
Cr M.P. 2118 K
1
2
3
4
5
6
7
8

FIG 157

SPECIFICATION TABLE NO. 157 THERMAL CONDUCTIVITY OF [NICKEL + CHROMIUM] ALLOYS

(Ni + Cr ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 157]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Cr	Composition (continued), Specifications and Remarks
1	230	L	1925	329			90	10	Prepared by fusing Ni (99.75 to 99.85 pure including Co, supplied by International Nickel Co.) and Cr (supplied by Eimel and Amend.); specimen ~5.5 cm long, 0.3 cm^2 cross sectional area; electrical conductivity 1403 ohm^{-1} cm^{-1} at 25 C.
2	230	L	1925	329			70	30	Similar to the above specimen except electrical conductivity 845 ohm^{-1} cm^{-1} at 25 C.
3	230	L	1925	329			60	40	Similar to the above specimen except electrical conductivity 813 ohm^{-1} cm^{-1} at 25 C.
4	230	L	1925	329			50	50	Similar to the above specimen except electrical conductivity 830 ohm^{-1} cm^{-1} at 25 C.
5	186	P	1928	305		Nichrome N	80	20	Specimen 0.25 cm dia; 8.40 g cm^{-3} density.
6	129	C	1933	373-795	3-5	Chromel P	90	10	Specimen 2 cm dia, 15 cm long; lead used as standard (0.352 watt cm^{-1} deg^{-1} at 0 C assumed value).
7	129	C	1933	373-788	3-5	Chromel A	80	20	Similar to the above specimen.
8	673	E	1952	309.1			80	20	Specimen 200 mm long; electrical conductivity 9520 ohm^{-1} cm^{-1} at 35.9 C.

DATA TABLE NO. 157 THERMAL CONDUCTIVITY OF [NICKEL + CHROMIUM] ALLOYS

(Ni + Cr ≥ 99.50%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
329.2	0.197
CURVE 2	
329.2	0.109
CURVE 3	
329.2	0.126
CURVE 4	
329.2	0.117
CURVE 5	
305	0.150
CURVE 6	
373.2	0.190
473.2	0.209
573.2	0.228
673.2	0.247
773.2	0.266
794.7	0.271
CURVE 7	
373.2	0.136
473.2	0.154
573.2	0.172
673.2	0.189
773.2	0.206
788.4	0.209
CURVE 8	
309.1	0.131

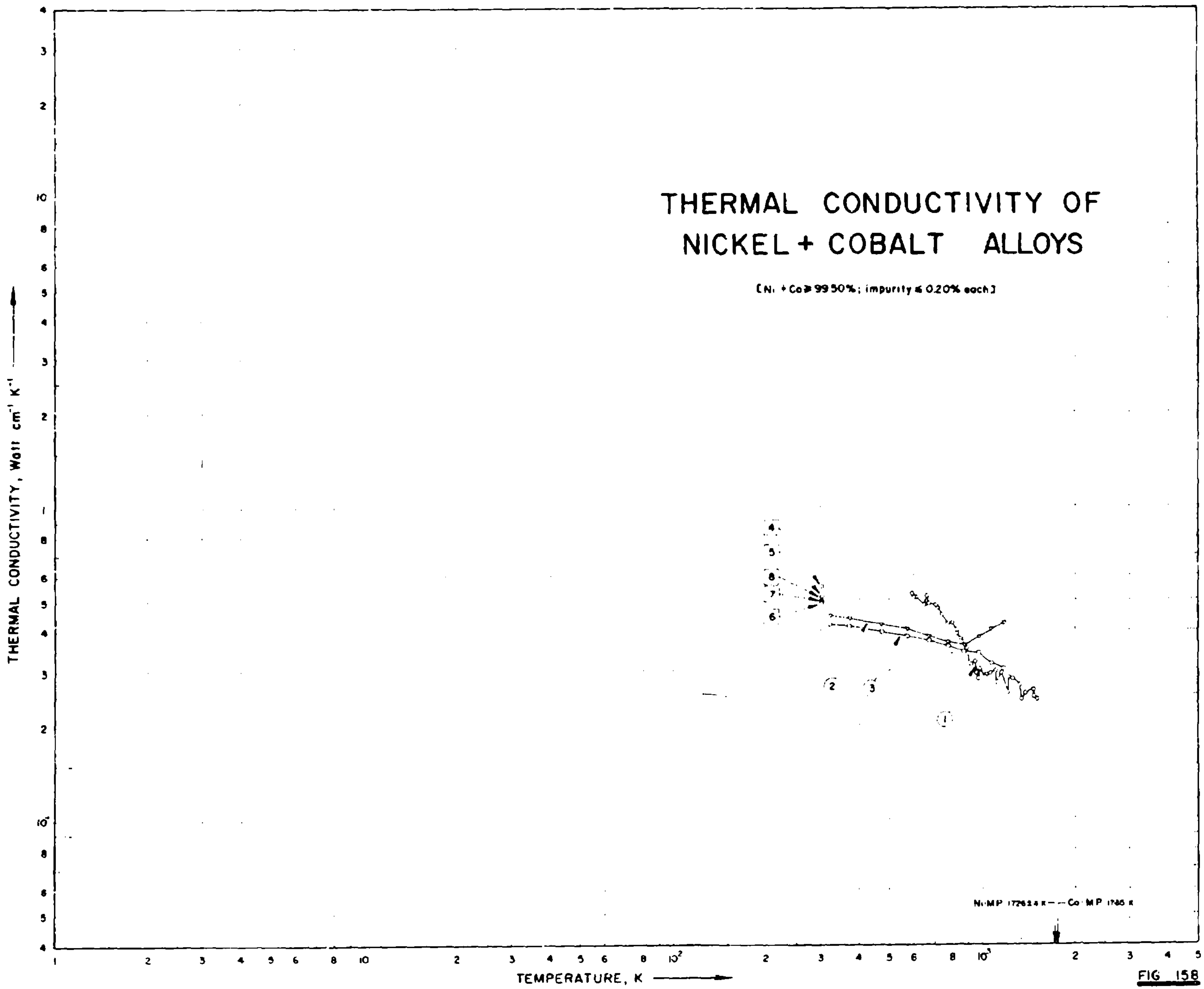

THERMAL CONDUCTIVITY OF
NICKEL + COBALT ALLOYS
[Ni + Co ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ni MP 1726.4 K — Co MP 1765 K
1
2
3
4
5
6
7
8

FIG 158

SPECIFICATION TABLE NO. 158 THERMAL CONDUCTIVITY OF [NICKEL + COBALT] ALLOYS

(Ni + Co ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 158]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Co	Composition (continued), Specifications and Remarks
1	4	E	1911	593-1508			~97.5	~2.5	Approximate composition; hollow cylindrical rod 6 in. long, 1.2 cm O.D. and 0.168 cm I.D.
2	131	C	1953	323-1173	2	RCA N91	78.1	21.6	0.185 Mn, 0.115 C, and 0.01 Mg; annealed at 1000 C; lead used as primary standard; advance (55 Cu, 45 Ni) used as working standard
3	131	C	1953	323-1173	2	RCA N97	59.5	40.0	0.175 Mn, 0.132 C, 0.19 Si, and 0.01 Mg; annealed at 1000 C.
4	238	E	1927	303			~90	~10	Impurities: 0.11 Fe, 0.06 C, trace P, 0.02 S, 0.009 Si, 0.005 Al, trace Mn, and 0.01 Cu; cast machined; annealed 40 min at 800 C; slowly cooled.
5	238	E	1927	303			~80	~20	Impurities: 0.12 Fe, 0.07 C, trace P, 0.02 S, 0.01 Si, 0.01 Al, trace Mn, and 0.01 Cu; cast, machined; annealed 40 min at 800 C, slowly cooled.
6	238	E	1927	303			~70	~30	Impurities: 0.13 Fe, 0.09 C, trace P, 0.002 S, 0.01 Si, 0.02 Al, trace Mn, and 0.009 Cu; cast, machined; annealed 40 min at 800 C, cooled slowly.
7	238	E	1927	303			~60	~40	Impurities: 0.14 Fe, 0.11 C, 0.001 P, 0.03 Si, 0.02 Al, trace Mn, and 0.008 Cu; cast, machined; annealed 40 min at 800 C, cooled slowly.
8	238	E	1927	303			~50	~50	Impurities: 0.15 Fe, 0.13 C, 0.002 P, 0.03 S, 0.02 Si, 0.03 Al, trace Mn, and 0.007 Cu; cast, machined, annealed for 40 min at 800 C, cooled slowly.

DATA TABLE NO. 158 THERMAL CONDUCTIVITY OF [NICKEL + COBALT] ALLOYS

(Ni + Co 99.50%, impurity 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
593.2	0.523
593.2	0.510*
598.2	0.510
608.2	0.519*
613.2	0.510
653.2	0.481
663.2	0.515
673.2	0.485
708.2	0.481
718.2	0.473
743.2	0.448
773.2	0.418
798.2	0.423
808.2	0.423
828.2	0.397
828.2	0.389
838.2	0.393*
838.2	0.389*
853.2	0.372
863.2	0.377*
883.2	0.339
893.2	0.351
898.2	0.360*
898.2	0.351*
908.2	0.314
923.2	0.310
948.2	0.319
958.2	0.293
972.2	0.280
978.2	0.276*
983.2	0.301
1023.2	0.285
1033.2	0.289
1043.2	0.289*
1068.2	0.293
1103.2	0.297
1113.2	0.272
1123.2	0.272*
1163.2	0.293
1213.2	0.255
1223.2	0.285
CURVE 1 (cont.)	
1223.2	0.259*
1263.2	0.280
1323.2	0.268
1343.2	0.243
1378.2	0.253
1473.2	0.259
1473.2	0.247
1483.2	0.247*
1508.2	0.243
CURVE 2	
323.20	0.446
373.2	0.437
473.2	0.419
573.2	0.401
673.2	0.383
773.2	0.366
873.2	0.359
973.2	0.380
1073.2	0.401
1173.2	0.421
CURVE 3	
323.2	0.418
373.2	0.411
473.2	0.396
573.2	0.384
673.2	0.370
773.2	0.356
873.2	0.343
973.2	0.339
1073.2	0.315
1173.2	0.301
CURVE 4	
303.2	0.552
CURVE 5	
303.2	0.515
CURVE 6	
303.2	0.490
CURVE 7	
303.2	0.498
CURVE 8	
303.2	0.506

* Not shown on plot

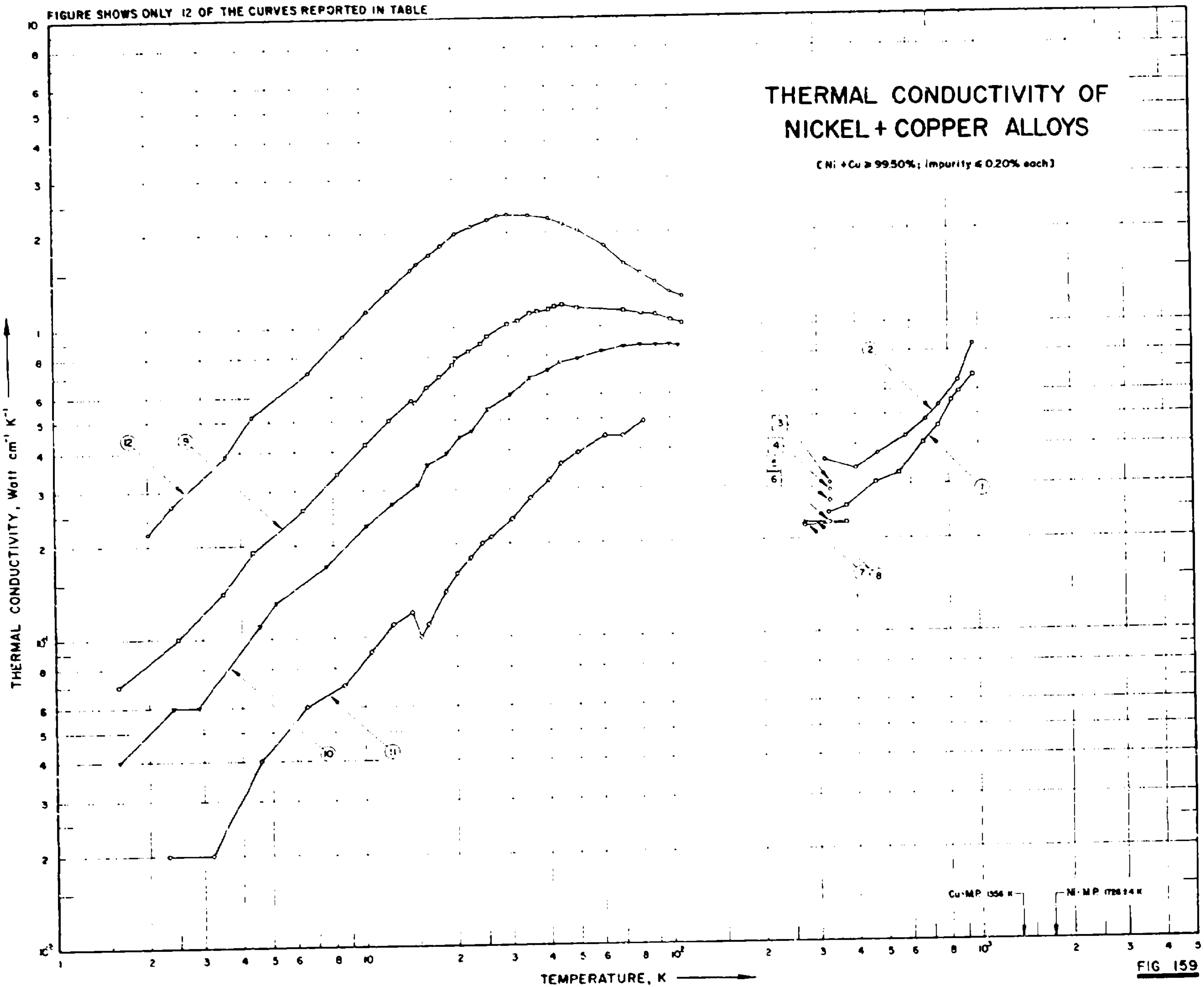


FIGURE SHOWS ONLY 12 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
NICKEL + COPPER ALLOYS
(Ni + Cu ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Cu-MP 1356 K
Ni-MP 1728±4 K
1
2
3
4
5
6
7, 8
9
10
11
12

FIG 159

SPECIFICATION TABLE NO. 159 THERMAL CONDUCTIVITY OF [NICKEL + COPPER] ALLOYS

(Ni + Cu ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 159]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Cu	Composition (continued), Specifications and Remarks
1	124	P	1930	325-970			~60	~40	0.2 Mn, trace Mg; annealed at 700 C, density 8.81 g cm^{-3}; electrical conductivity ranging from 1.88 to 1.74 x 10^4 ohm^{-1} cm^{-1} at 52 to 697 C.
2	124	P	1930	317-966			~80	~20	0.2 Mn, trace Mg; annealed at 700 C, density 8.82 g cm^{-3}; electrical conductivity ranging from 3.36 to 1.96 x 10^4 ohm^{-1} cm^{-1} at 44 to 693 C.
3	230	L	1925	330			80	20	Prepared by fusing Ni (99.75 to 99.85 pure, supplied by International Nickel Co.) and Cu (< 0.03 impurities, supplied by Baker); specimen ~5.5 cm long, 0.3 cm^2 cross sectional area; electrical conductivity 3.00 x 10^4 ohm^{-1} cm^{-1} at 25 C.
4	230	L	1925	330			70	30	Similar to the above specimen except electrical conductivity 2.17 x 10^4 ohm^{-1} cm^{-1} at 25 C.
5	230	L	1925	330			60	40	Similar to the above specimen except electrical conductivity 2.02 x 10^4 ohm^{-1} cm^{-1} at 25 C.
6	230	L	1925	330			50	50	Similar to the above specimen except electrical conductivity 1.98 x 10^4 ohm^{-1} cm^{-1} at 25 C.
7	246	T	1919	273, 373			60.93	39.07	Rolled and drawn; annealed close to melting point for 1/2 hr.
8	246	T	1919	273, 373			81.63	18.37	Similar to the above specimen.
9	917	E	1965	1.6-111	0.5-5	C		.	0.649 ± 0.104 Cu from x-ray microanalysis (0.865 Cu from residue resistivity measurement); specimen 4 mm in dia; supplied by Johnson Matthey and Co.; chill cast from J.M. 890 Ni and J.M. 30 Cu; annealed for 12 hrs at 850 C; electrical resistivity 1.0 x 10^{-3}, 4.99 x 10^{-3}, 1.422 x 10^{-2}, 3.16 x 10^{-2}, 4.27 x 10^{-2}, 7.48 x 10^{-2} and 8.79 x 10^{-2} μohm cm at 4.1, 10.1, 16.0, 21.8, 25.2, 31.8 and 34.1 K respectively.
10	917	E	1965	1.6-107	0.5-5	D		.	1.65 ± 0.32 Cu from x-ray microanalysis (1.73 Cu from residue resistivity measurement); specimen 4 mm in dia; supplied by Johnson Matthey and Co.; chill cast from J.M. 890 Ni and J.M. 30 Cu; annealed for 12 hrs at 850 C; electrical resistivity 1.01 x 10^{-3}, 5.12 x 10^{-3}, 2.12 x 10^{-2}, 3.57 x 10^{-2}, 5.63 x 10^{-2}, and 8.185 x 10^{-2} μohm cm at 3.4, 7.4, 15.8, 20.1, 24.8 and 29.6 K, respectively.

SPECIFICATION TABLE NO. 159 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Cu	Composition (continued), Specifications and Remarks
11	917	E	1965	2.3-82.4	0.5-5	E			4.52 ± 0.65 Cu from x-ray microanalysis (5.28 Cu from residue resistivity measurement); specimen 4 mm in dia; supplied by Johnson Matthey and Co.; chill cast from J.M. 890 Ni and J.M. 30 Cu; annealed for 12 hrs at 850 C; electrical resistivity 9.02×10^{-3}, 2.01×10^{-2}, 4.67×10^{-2} and 8.71×10^{-2} μohm cm at 8.5, 12.2, 21.7 and 29.3 K, respectively.
12	917	E	1965	2.0-111	0.5-5	F			0.236 ± 0.054 Cu from x-ray microanalysis (0.172 Cu from residue resistivity measurement); specimen 4 mm in dia; supplied by Johnson Matthey and Co.; chill cast from J.M. 890 Ni and J.M. 30 Cu; annealed for 12 hrs at 850 C; electrical resistivity 1.1×10^{-3}, 4.634×10^{-3}, 1.05×10^{-2}, 2.4×10^{-2}, 4.62×10^{-2} and 7.15×10^{-2} μohm cm at 6.3, 1.2, 1.6, 21.9, 28.9 and 34.6 K, respectively.

DATA TABLE NO. 159 THERMAL CONDUCTIVITY OF [NICKEL + COPPER] ALLOYS

(Ni + Cu 99.50%, impurity 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
325.2	0.243
374.2	0.255
467.2	0.305
552.2	0.326
667.2	0.406
747.2	0.456
827.2	0.552
868.2	0.590
970.2	0.669

CURVE 2

T	k
317.2	0.360
401.2	0.339
471.2	0.377
584.2	0.427
679.2	0.481
[illegible]	0.536
[illegible]	0.643
[illegible]	0.849

CURVE 3

T	k
330.0	0.305

CURVE 4

T	k
330.0	0.289

CURVE 5

T	k
330.0	0.266

CURVE 6

T	k
330.0	0.226

CURVE 7

T	k
273.2	0.22
373.2	0.26

CURVE 8

T	k
273.2	0.26
373.2	0.26

CURVE 9

T	k
1.6	0.07
2.5	0.10
3.5	0.14
4.4	0.19
6.4	0.26
8.3	0.34
10.3	0.42
12.3	0.50
14.5	0.58
14.9	0.57
16.3	0.64
17.9	0.69
19.7	0.75
20.3	0.79
22.2	0.83
24.4	0.88
25.6	0.93
29.8	1.02
32.2	1.05
35.1	1.11
37.4	1.12
40.6	1.14
42.5	1.16
45.3	1.18
50.2	1.15
71.4	1.12
81.1	1.10
90.4	1.09
101.0	1.05
110.6	1.02

CURVE 10

T	k
1.6	0.04
2.4	0.06
2.9	0.06
4.6	0.11
5.2	0.13

CURVE 10 (cont.)

T	k
7.6	0.17
10.2	0.23
12.5	0.27
15.1	0.31
16.2	0.36
18.9	0.39
20.7	0.44
22.8	0.46
25.7	0.54
30.5	0.60
35.3	0.68
40.2	0.72
45.4	0.76
50.4	0.78
60.3	0.82
71.4	0.85
80.4	0.86
90.2	0.86
100.4	0.86
101.7	0.85*
107.3	0.85

CURVE 11

T	k
2.3	0.02
3.2	0.02
4.6	0.04
6.5	0.06
8.6	0.07
10.6	0.09
12.5	0.11
14.4	0.12
15.4	0.10
16.3	0.11
18.5	0.14
20.1	0.16
22.4	0.18
24.4	0.20
26.1	0.21
30.6	0.24
35.0	0.28
40.4	0.32
45.2	0.36

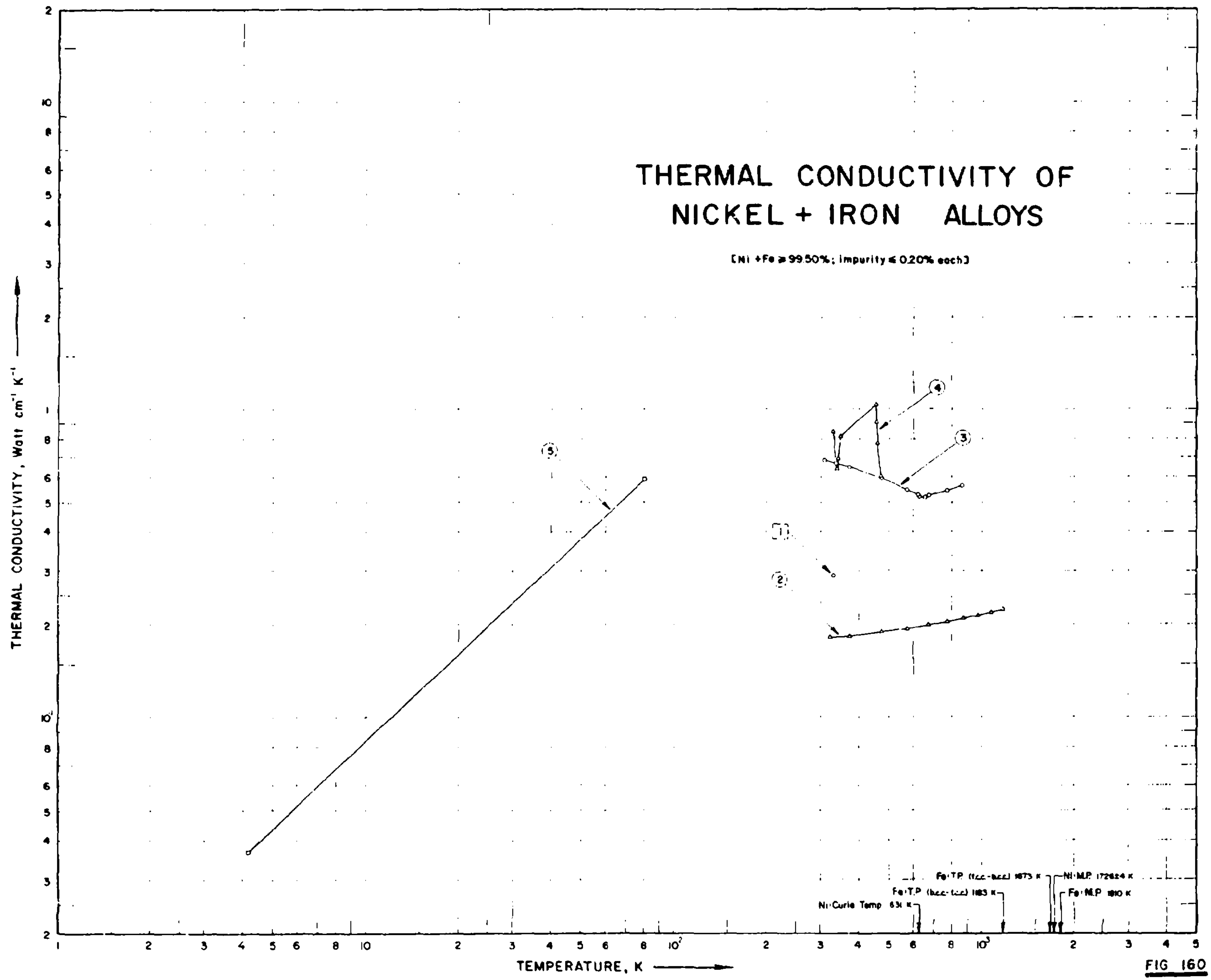
CURVE 11 (cont.)

T	k
50.2	0.39
61.7	0.44
70.1	0.44
82.1	0.49

CURVE 12

T	k
2.0	0.22
2.4	0.27
3.6	0.39
4.4	0.52
6.7	0.72
8.7	0.94
10.4	1.14
12.3	1.31
14.6	1.52
15.2	1.60
16.7	1.71
18.2	1.83
20.3	1.99
22.9	2.10
26.0	2.21
27.9	2.27
30.1	2.29
35.2	2.28
40.9	2.23
45.5	2.14
51.0	2.03
62.1	1.81
71.8	1.59
81.3	1.48
90.3	1.37
100.8	1.28
111.4	1.24

* Not shown on plot



THERMAL CONDUCTIVITY OF NICKEL + IRON ALLOYS
[Ni + Fe ≥ 99.50%; Impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ni Curie Temp 631 K
Fe T.P. (bcc-fcc) 1183 K
Fe T.P. (fcc-bcc) 1673 K
Ni M.P. 1726±4 K
Fe M.P. 1810 K
1
2
3
4
5

FIG 160

SPECIFICATION TABLE NO. 160 THERMAL CONDUCTIVITY OF [NICKEL + IRON] ALLOYS

(Ni + Fe ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 160]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Fe	Composition (continued), Specifications and Remarks
1	206		1920	330.2			75.1	24.9	Prepared from Fe (99.97 pure), Ni (high purity); 0.1 C; specimen ~5.8 cm long, 0.98 cm dia.
2	131	C	1953	323-1173	2		50.85	48.50	0.12 Mn, 0.24 C, and 0.003 S; annealed at 950 C; lead used as primary standard; Advance (55 Cu, 45 Ni) used as working standard.
3	129	C	1933	309-365	5	N.S. nickel, commercial	99*	0.6	0.14 Cu, 0.09 Mn, and 0.014 S; specimen 2 cm dia, 15 cm long (0.352 watt cm^{-1} deg^{-1} at 0 C, assumed value).
4	305	L	1953	328-472		commercial nickel	99.4	0.2	0.1 Mg, 0.05 Co, 0.03 Sn, 0.02 Si, 0.026 C, 0.01 Cr, 0.01 Mn, 0.003 Ti, 0.002 each of Al and Pb, and 0.005 S; experimental method inaccurate.
5	716	L	1962	4.2-81			85.2	14.8	Specimen 0.2 cm dia, 5.2 cm long; fused in an induction furnace under vacuo of 10^{-3} torr, from Ni and Fe supplied by Johnson-Matthey; cold rolled, annealed at 1173 K for 2 hrs; slowly cooled.

DATA TABLE NO. 160 THERMAL CONDUCTIVITY OF [NICKEL + IRON] ALLOYS

(Ni + Fe ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k
CURVE 1		**CURVE 5**	
330.2	0.289	4.18	0.0367
		80.5	0.589
CURVE 2			
323.2	0.181		
373.2	0.183		
473.2	0.189		
573.2	0.194		
673.2	0.199		
773.2	0.204		
873.2	0.209		
973.2	0.214		
1073.2	0.219		
1173.2	0.224		
CURVE 3			
309.2	0.682		
336.6	0.668		
373.2	0.649		
473.2	0.599		
573.2	0.549		
622.9	0.527		
627.2	0.522		
653.8	0.519		
673.2	0.524		
773.2	0.546		
864.6	0.566		
CURVE 4			
328.2	0.845		
340.2	0.640		
342.2	0.690		
347.2	0.816		
452.2	1.038		
457.2	0.908		
457.2	0.774		
472.2	0.598		

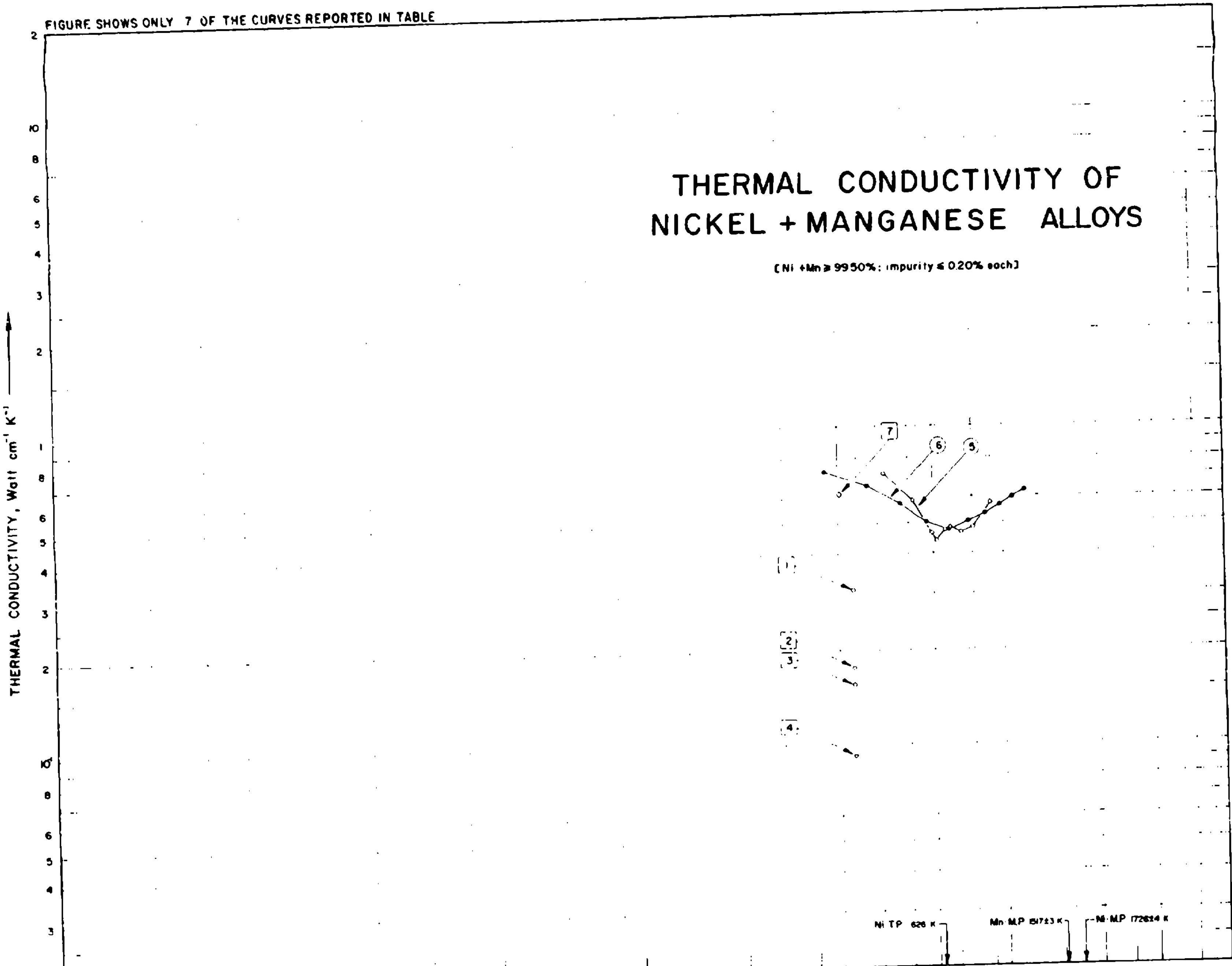


FIGURE SHOWS ONLY 7 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF NICKEL + MANGANESE ALLOYS
[Ni + Mn ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ni T.P. 626 K
Mn M.P. 1517±3 K
Ni M.P. 1728±4 K
1
2
3
4
5
6
7

FIG 161

SPECIFICATION TABLE NO. 161 THERMAL CONDUCTIVITY OF [NICKEL + MANGANESE] ALLOYS

(Ni + Mn ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 161]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Mn	Composition (continued), Specifications and Remarks
1	230	L	1925	333			90	10	Prepared from Ni (99.75 to 99.85 pure including Co, supplied by International Nickel Co.) and Mn (pure); specimen ~5.5 cm long, 0.3 cm² cross sectional area; electrical conductivity 27.7 x 10^2 ohm^{-1} cm^{-1} at 25 C.
2	230	L	1925	333			80	20	Similar to the above specimen except electrical conductivity 14.2 x 10^3 ohm^{-1} cm^{-1} at 25 C.
3	230	L	1925	333			70	30	Similar to the above specimen except electrical conductivity 10.4 x 10^3 ohm^{-1} cm^{-1} at 25 C.
4	230	L	1925	333			50	50	Similar to the above specimen except electrical conductivity 3.56 x 10^{3} ohm^{-1} cm^{-1} at 25 C.
5	420	C	1957	420-914		A-Nickel	99.54	0.25	0.07 Fe, 0.03 Co, 0.03 Si, 0.03 Mg and traces of other metals. Armco iron used as standard.
6	490	F	1950	273-1173		A-Nickel	99.48	0.22	0.06 C, 0.02 Si, 0.005 S, 0.05 Cu, and 0.14 Fe; specimen 0.635 cm dia, 30 cm long, electrical conductivity reported as 11.3, 5.12, 2.87, 2.40, 2.10, and 2.02 x 10^4 ohm^{-1} cm^{-1} at 0, 200, 400, 600, 800, and 900 C, respectively.
7	186	P	1928	305		Grade A	99.4	0.20	0.1 Cu, 0.15 Fe, 0.05 Si, 0.1 C, 0.005 S.
8	26	C	1954	422-910	5-19	A-Nickel	99.512	0.25	0.068 Fe, 0.034 each of Co and Mg, 0.03 Si, 0.02 Ti, 0.006 Al, 0.001 B, 0.014 Cu, 0.0005 each of Ca and Cr; specimen 2 cm in dia and 15.25 cm long; Armco iron used as comparative material.

DATA TABLE NO. 161 THERMAL CONDUCTIVITY OF [NICKEL + MANGANESE] ALLOYS

($Ni + Mn \geq 99.50\%$; impurity $< 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
333	0.310
CURVE 2	
333	0.176
CURVE 3	
333	0.155
CURVE 4	
333	0.092
CURVE 5	
420.4	0.715
520.0	0.590
594.8	0.464
617.4	0.439
655.9	0.473
680.8	0.481
739.7	0.469
800.8	0.485
914.1	0.577
CURVE 6	
273.2	0.728
373.2	0.653
473.2	0.577
573.2	0.502
673.2	0.477
773.2	0.506
873.2	0.536
973.2	0.569
1073.2	0.598
1173.2	0.628
CURVE 7	
305.2	0.615

T	k
CURVE 8*	
422.65	0.7130
521.31	0.5909
597.39	0.4636
618.55	0.4349
656.22	0.4731
678.87	0.4790
739.15	0.4676
799.59	0.4909
969.53	0.5777

* Not shown on plot

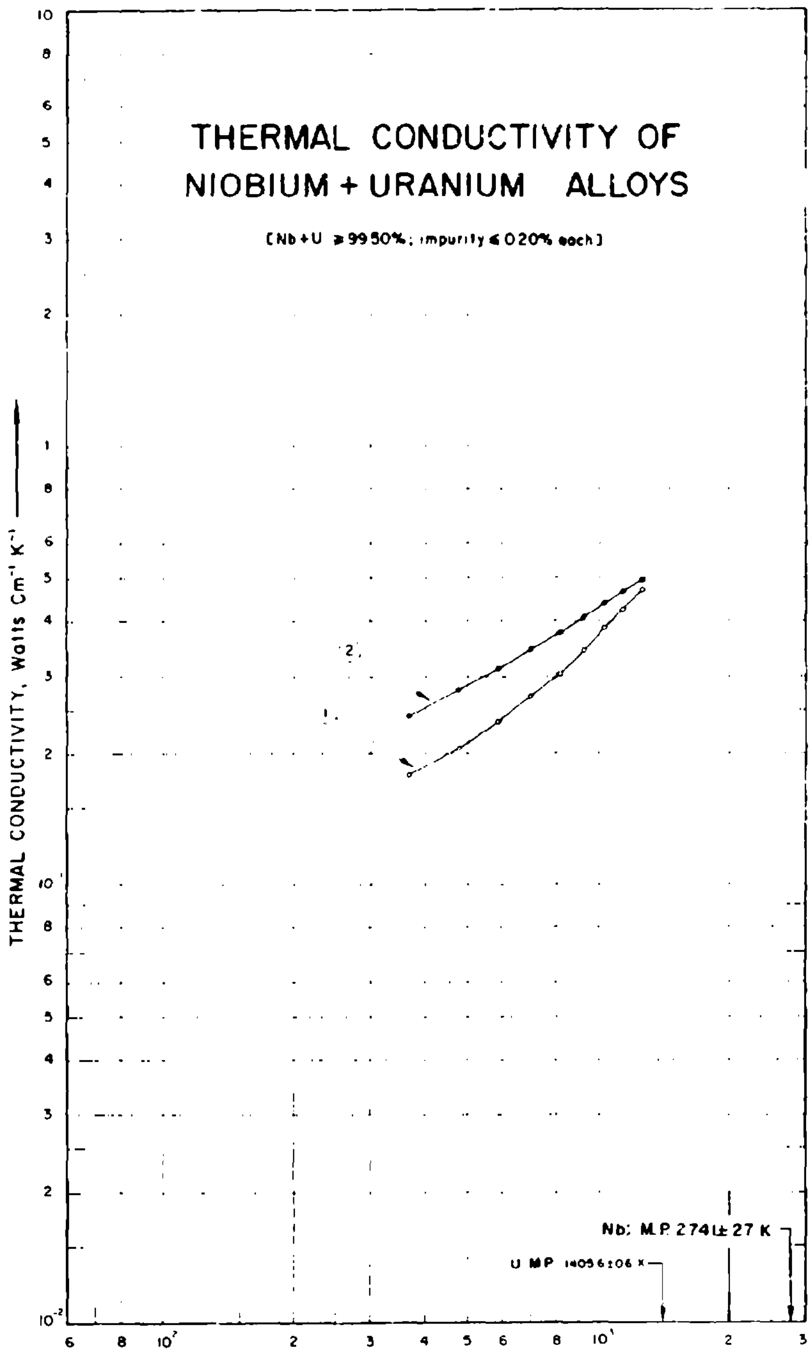

THERMAL CONDUCTIVITY OF
NIOBIUM + URANIUM ALLOYS
[Nb+U ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}
TEMPERATURE, K
Nb; M.P. 2741± 27 K
U M.P. 1405.6±0.6 K
1
2

FIG 162

SPECIFICATION TABLE NO. 162 THERMAL CONDUCTIVITY OF [NIOBIUM + URANIUM] ALLOYS

(Nb + U ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 162]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Nb	U	Composition (continued), Specifications and Remarks
1	489	C	1961	367-1255			90	10	Prepared by arc casting Nb (> 99.8 pure) and U (pure); measured in vacuo of 2×10^{-5} mm Hg. Armco iron used as standard.
2	489	C	1961	367-1255			80	20	Similar to the above specimen.

DATA TABLE NO. 162 THERMAL CONDUCTIVITY OF [NIOBIUM + URANIUM] ALLOYS

(Nb + U ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
366.5	0.177
477.6	0.205
588.7	0.235
699.9	0.268
811.0	0.304
922.2	0.341
1033.2	0.384
1144.3	0.425
1255.4	0.470
CURVE 2	
366.5	0.242
477.6	0.277
588.7	0.312
699.9	0.343
811.0	0.374
922.2	0.406
1033.2	0.439
1144.3	0.466
1255.4	0.493

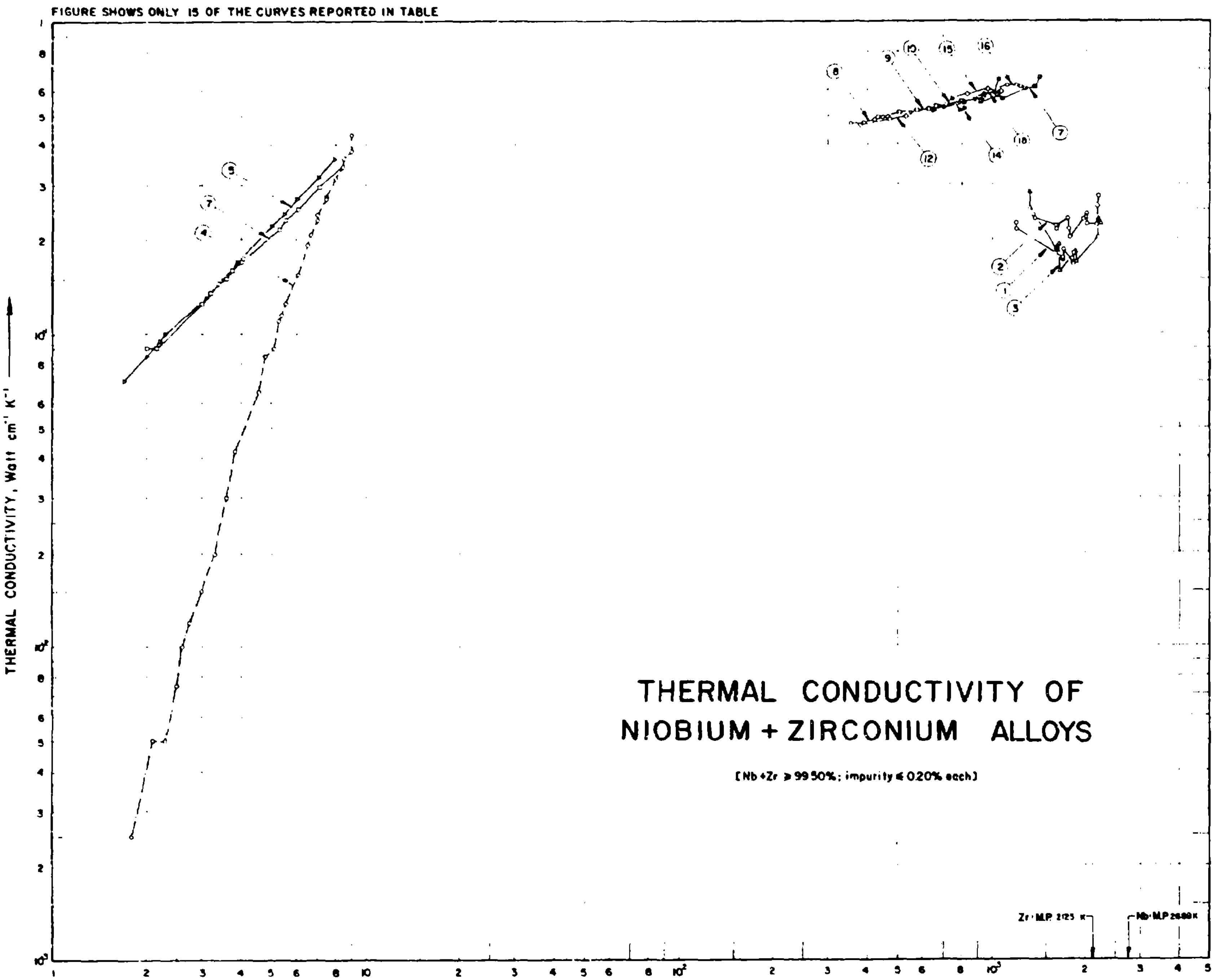


FIGURE SHOWS ONLY 15 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
THERMAL CONDUCTIVITY OF NIOBIUM + ZIRCONIUM ALLOYS
[Nb+Zr ≥ 99.50%; impurity ≤ 0.20% each]
Zr: M.P. 2125 K
Nb: M.P. 2688 K

FIG. 163

SPECIFICATION TABLE NO. 163 THERMAL CONDUCTIVITY OF NIOBIUM + ZIRCONIUM ALLOYS

(Nb + Zr ≥ 99.50%; impurity ≤ 0.20% each)

For Data Reported in Figure and Table No. 163

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Nb	Zr	Composition (continued), Specifications and Remarks
1	544	R	1963	1200-1855	6	Nb - 0.5 Zr	99.5	0.5	Specimen 0.75 in. long, 0.75 in. O.D., and 0.25 in. I.D.; ground; surface scratches eliminated; annealed at 3350 F.
2	544	R	1963	1532-2178	6	Nb - 0.5 Zr	99.5	0.5	The above specimen remeasured; partially melted during test.
3	544	R	1963	1322-2225	6	Nb - 0.5 Zr	99.5	0.5	Specimen 3 in. long, 2.5 in. O.D., 0.75 in. I.D.; ground; surface scratches eliminated; discolored during test.
4	725	L	1963	1.8-9.0			99.8	0.2	Specimen 1 mm wire; annealed in vacuo; in superconducting state.
5	725	L	1963	1.7-8.0			99.8	0.2	The above specimen measured in a magnetic field of 10,000 gauss; in normal state.
6	725	L	1963	1.9-8.5			98.0	2.0	Similar to the above specimen but in superconducting state.
7	725	L	1963	2.0-8.5			98.0	2.0	The above specimen measured in a magnetic field of 10,000 gauss; in normal state.
8	766,925, 855	C	1963	355-465	±4		99.0	1.0	Armco iron used as comparative material; interpolated electrical resistivity 19.5, 23.7, 27.7, 31.4, 35.1, 38.7, 42.1 and 45.4 μohm cm at 100, 200, 300, 400, 500, 600, 700 and 800 C, respectively; run No. 1, equilibrium No. 1.
9	766,925, 855	C	1963	433-664	±4				The above specimen run No. 1, equilibrium No. 2.
10	766,925, 855	C	1963	549-941	±4				The above specimen run No. 1, equilibrium No. 3
11	766,925, 855	C	1963	616-1087	±4				The above specimen run No. 1, equilibrium No. 4.
12	766,925, 855	C	1963	379-531	±4				The above specimen run No. 1, equilibrium No. 5.
13	766,925, 855	C	1963	420-545	±4				The above specimen run No. 2, equilibrium No. 1.
14	766,925, 855	C	1963	650-919	±4				The above specimen run No. 2, equilibrium No. 2.
15	766,925, 855	C	1963	722-1077	±4				The above specimen run No. 2, equilibrium No. 3.
16	766,925, 855	C	1963	818-1243	±4				The above specimen run No. 2, equilibrium No. 4.

SPECIFICATION TABLE NO. 163 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Nb	Zr	Composition (continued), Specifications and Remarks
17	766,925, 855	C	1963	922-1421	±4				The above specimen run No. 2, equilibrium No. 5.
18	766,925, 855	C	1963	704-1051	±4				The above specimen run No. 2, equilibrium No. 6.

DATA TABLE NO. 163 THERMAL CONDUCTIVITY OF [NIOBIUM + ZIRCONIUM] ALLOYS

(Nb + Zr ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
1199.8	0.225
1199.8	0.215
1199.8	0.234
1693.7	0.174
1697.1	0.172
1697.1	0.185
1833.7	0.167
1835.4	0.180

CURVE 2

T	k
1352.1	0.240
1370.9	0.237
1610.9	0.221
1611.5	0.214
1618.7	0.220
1760.4	0.231
1773.7	0.215
1777.1	0.202
1976.5	0.232
2014.8	0.240
2014.8	0.224
2158.2	0.223
2174.3	0.225*
2175.9	0.255
2178.2	0.276

CURVE 3

T	k
1321.5	0.281
1328.2	0.252
1616.5	0.185
1640.4	0.183
1641.5	0.192
1647.1	0.159
1854.8	0.183
1856.5	0.180*
1870.9	0.169
2188.2	0.203
2198.2	0.234
2225.4	0.225

CURVE 4

T	k
1.8	0.0025
2.1	0.005
2.3	0.005
2.5	0.0075
2.6	0.010
2.75	0.012
3.0	0.015
3.3	0.020
3.6	0.030
3.85	0.042
4.55	0.065
4.8	0.085
5.1	0.090
5.3	0.110
5.4	0.115
5.55	0.125
6.1	0.155
6.55	0.192
6.7	0.207
7.0	0.230
7.05	0.240
7.5	0.270
7.5	0.275
8.0	0.315
8.45	0.340
8.5	0.362
9.0	0.380
9.05	0.430

CURVE 5

T	k
1.7	0.070
2.0	0.085
2.2	0.095
2.3	0.100
3.1	0.130
3.9	0.170
5.0	0.220
5.5	0.240
6.05	0.270
7.05	0.315
7.95	0.360

CURVE 6

T	k
1.9	0.0025
2.15	0.0025
2.5	0.010
2.65	0.012
2.9	0.015
3.05	0.017
3.2	0.020
3.4	0.025
3.6	0.030
3.8	0.035
4.0	0.045
4.3	0.055
4.5	0.060
5.05	0.090
5.55	0.120
6.05	0.155
6.55	0.185
7.05	0.230
7.5	0.275
7.95	0.320
8.45	0.367

CURVE 7

T	k
2.0	0.090
2.15	0.090
3.0	0.125
3.2	0.135
3.4	0.145
3.6	0.150
3.75	0.160
4.0	0.170
5.3	0.215
5.55	0.230
6.1	0.250
7.1	0.295
8.5	0.355*

CURVE 8

T	k
355.2	0.473
390.2	0.475

CURVE 8 (cont.)

T	k
424.2	0.488
449.2	0.494
465.2	0.495

CURVE 9

T	k
433.2	0.492
506.2	0.510
577.2	0.520
630.2	0.524
664.2	0.534

CURVE 10

T	k
549.2	0.512
676.2	0.533
797.2	0.553
885.2	0.558
941.2	0.568

CURVE 11*

T	k
616.2	0.519
770.2	0.543
915.2	0.570
1020	0.557
1087	0.573

CURVE 12

T	k
379.2	0.458
427.2	0.482*
474.2	0.489
509.2	0.511*
531.2	0.495

CURVE 13*

T	k
420.2	0.480
460.2	0.492
508.2	0.548
535.2	0.491
545.2	0.490

CURVE 14

T	k
650.2	0.518
745.2	0.564
791.2	0.520
819.2	0.526

CURVE 15

T	k
722.2	0.549*
835.2	0.580
971.2	0.601
1077	0.593

CURVE 16

T	k
818.2	0.573*
955.2	0.554*
1119	0.619
1202	0.620
1243	0.612

CURVE 17*

T	k
922.2	0.548
1042	0.575
1083	0.563
1276	0.604
1377	0.613
1421	0.658

CURVE 18

T	k
704.2	0.530
816.2	0.548
949.2	0.581
1020	0.588
1051	0.647

* Not shown on plot

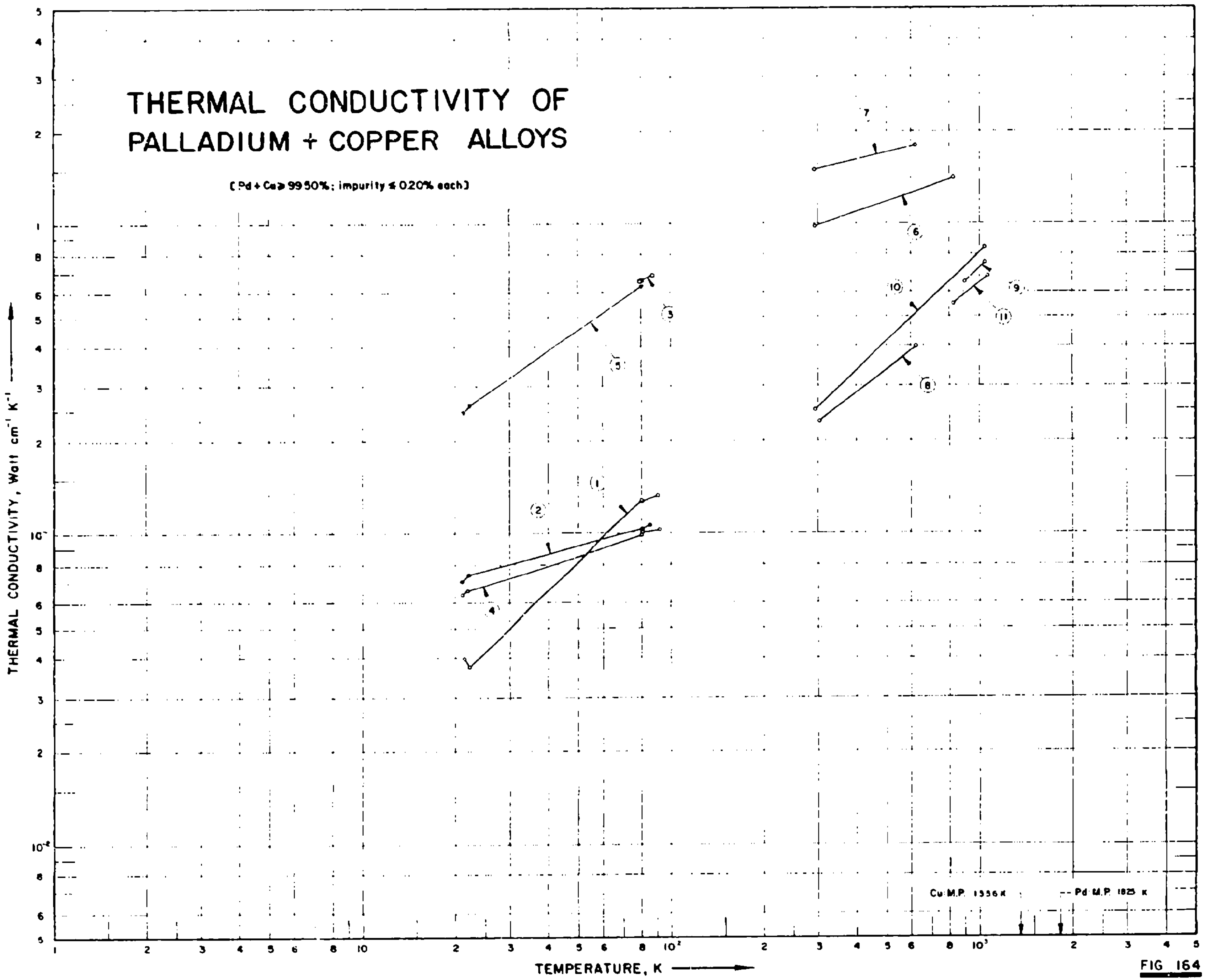

THERMAL CONDUCTIVITY OF
PALLADIUM + COPPER ALLOYS
(Pd + Cu ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Cu M.P. 1356 K
Pd M.P. 1825 K
1
2
3
4
5
6
7
8
9
10
11

FIG 164

SPECIFICATION TABLE NO. 164 THERMAL CONDUCTIVITY OF [PALLADIUM + COPPER] ALLOYS

(Pd + Cu ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 164]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pd	Cu	Composition (continued), Specifications and Remarks
1	58	L	1934	21-91		18	90.8	9.2	Unannealed polycrystal; $\rho(0C)$ = 28.05 μohm cm.
2	58	L	1934	21-85		19	62.7	37.3	Annealed; electrical resistivity 36.8 and 37.15 μohm cm at 275.15 and 291.60K, respectively.
3	58	L	1934	79-87		21a	57.8	42.2	Annealed; electrical resistivity 5.1 and 5.32 μohm cm at 273.2 and 292.6K, respectively.
4	58	L	1934	21-92		21b	57.8	42.2	The above specimen annealed in vacuo for 2 hrs at ~850 C.
5	58	L	1934	21-80		21c	57.8	42.2	The above specimen annealed at ~325 C for 30 hrs.
6	391	L	1958	293, 823	3		52.75	47.25	Calculated composition; specimen from a 0.2 mm thick sheet; cold rolled, annealed for 2 hrs at ~650 C; ordered atomic arrangement.
7	391	L	1958	293, 623	3		57.81	42.19	Similar to the above specimen.
8	391	L	1958	303, 623	3		70.67	29.33	Similar to the above specimen.
9	391	L	1958	893, 1048	3		52.75	47.25	Similar to the above specimen except disordered atomic arrangement.
10	391	L	1958	293, 1048	3		57.81	42.19	Similar to the above specimen.
11	391	L	1958	821, 1073	3		70.67	29.33	Similar to the above specimen.

DATA TABLE NO. 164 THERMAL CONDUCTIVITY OF [PALLADIUM + COPPER] ALLOYS

(Pd + Cu ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k
CURVE 1	
21.4	0.0396
22.2	0.0372
80.0	0.129
80.5	0.128
91.3	0.134
CURVE 2	
21.0	0.0706
22.1	0.0742
80.4	0.103
85.3	0.107
CURVE 3	
79.3	0.652
80.9	0.658
86.6	0.683
CURVE 4	
21.1	0.0634
21.9	0.0658
80.2	0.0988
80.7	0.101
92.0	0.103
CURVE 5	
21.3	0.246
22.3	0.259
80.2	0.628
CURVE 6	
293.2	0.98
823.2	1.42
CURVE 7	
293.2	1.50
623.2	1.80
CURVE 8	
303.2	0.23
623.2	0.40
CURVE 9	
893.2	0.65
1048.2	0.75
CURVE 10	
293.2	0.25
1048.2	0.84
CURVE 11	
821.2	0.55
1073.2	0.68

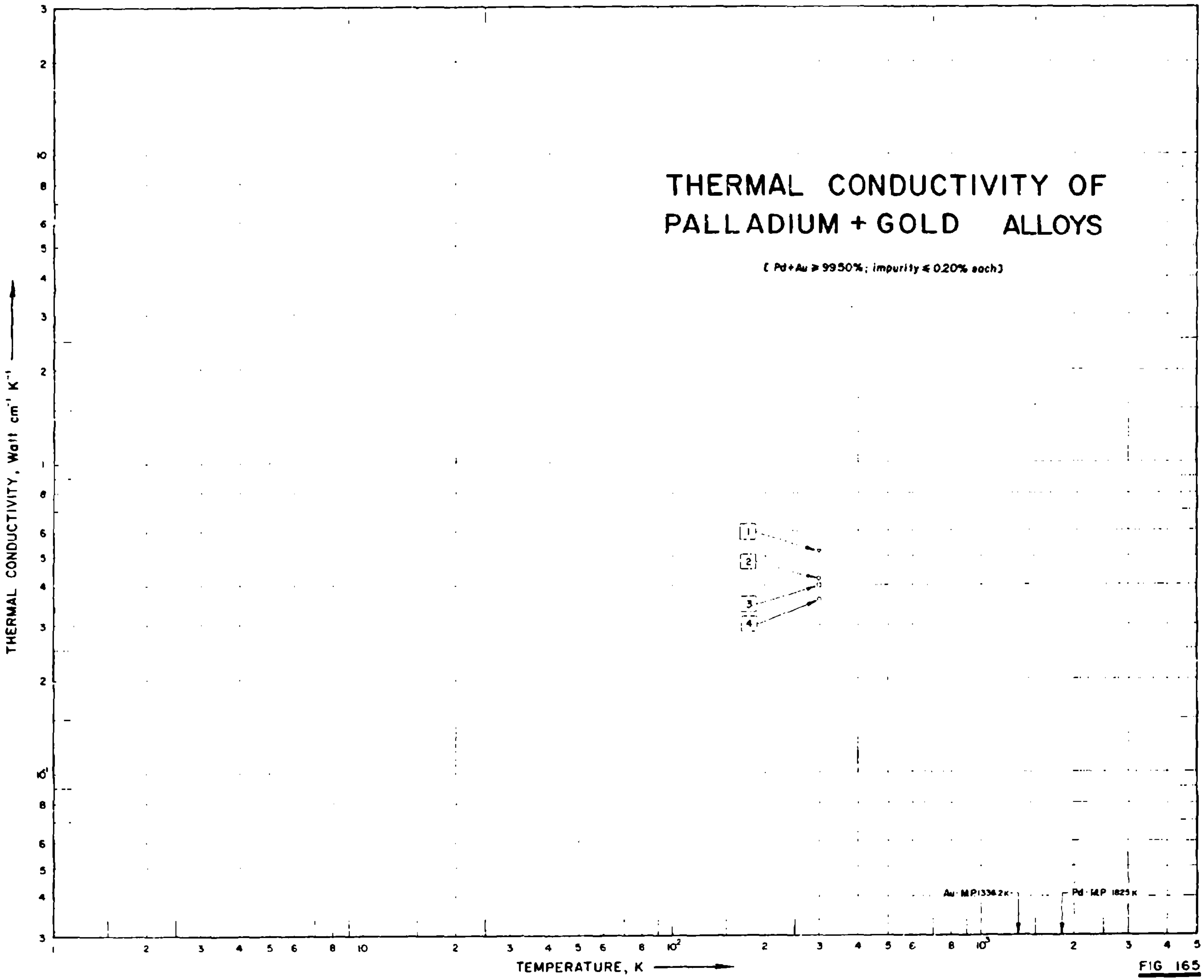

THERMAL CONDUCTIVITY OF
PALLADIUM + GOLD ALLOYS
(Pd+Au ≥ 99.50%; impurity ≤ 0.20% each)
1
2
3
4
Au M.P. 1336.2 K
Pd M.P. 1825 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 165

SPECIFICATION TABLE NO. 165 THERMAL CONDUCTIVITY OF [PALLADIUM + GOLD] ALLOYS

(Pd + Au ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 165]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pd	Au	Composition (continued), Specifications and Remarks
1	241	E	1911	298.2			90	10	Approx. composition; electrical conductivity 6.65 x 10^4 ohm^{-1} cm^{-1} at 25 C.
2	241	E	1911	298.2			80	20	Approx. composition, electrical conductivity 5.33 x 10^4 ohm^{-1} cm^{-1} at 25 C.
3	241	E	1911	298.2			70	30	Approx. composition; electrical conductivity 4.72 x 10^4 ohm^{-1} cm^{-1} at 25 C.
4	241	E	1911	298.2			60	40	Approx. composition; electrical conductivity 3.89 x 10^4 ohm^{-1} cm^{-1} at 25 C.
5	241	E	1911	298.2			50	50	Approx. composition; electrical conductivity 3.74 x 10^4 ohm^{-1} cm^{-1} at 25 C.

DATA TABLE NO. 165 THERMAL CONDUCTIVITY OF [PALLADIUM + GOLD] ALLOYS

(Pd + Au ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
298.2	0.52
CURVE 2	
298.2	0.42
CURVE 3	
298.2	0.40
CURVE 4	
298.2	0.36
CURVE 5*	
298.2	0.36

*Not shown on plot

SPECIFICATION TABLE NO. 166 THERMAL CONDUCTIVITY OF [PALLADIUM + PLATINUM] ALLOYS

(Pd + Pt ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pd	Pt	Composition (continued), Specifications and Remarks
1	241	E	1911	298.2			90	10	Approx composition; electrical conductivity 6.56 x 10^4 $ohm^{-1}cm^{-1}$ at 25 C.
2	241	E	1911	298.2			80	20	Approx composition; electrical conductivity 5.07 x 10^4 $ohm^{-1}cm^{-1}$ at 25 C.
3	241	E	1911	298.2			70	30	Approx composition; electrical conductivity 4.43 x 10^4 $ohm^{-1}cm^{-1}$ at 25 C.
4	241	E	1911	298.2			60	40	Approx composition; electrical conductivity 4.02 x 10^4 $ohm^{-1}cm^{-1}$ at 25 C.
5	241	E	1911	298.2			50	50	Approx composition; electrical conductivity 3.79 x 10^4 $ohm^{-1}cm^{-1}$ at 25 C.

DATA TABLE NO. 166 THERMAL CONDUCTIVITY OF [PALLADIUM + PLATINUM] ALLOYS

(Pd + Pt ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 4*	
298.2	0.560	298.2	0.380
CURVE 2*		CURVE 5*	
298.2	0.440	298.2	0.370
CURVE 3*			
298.2	0.400		

* No graphical presentation

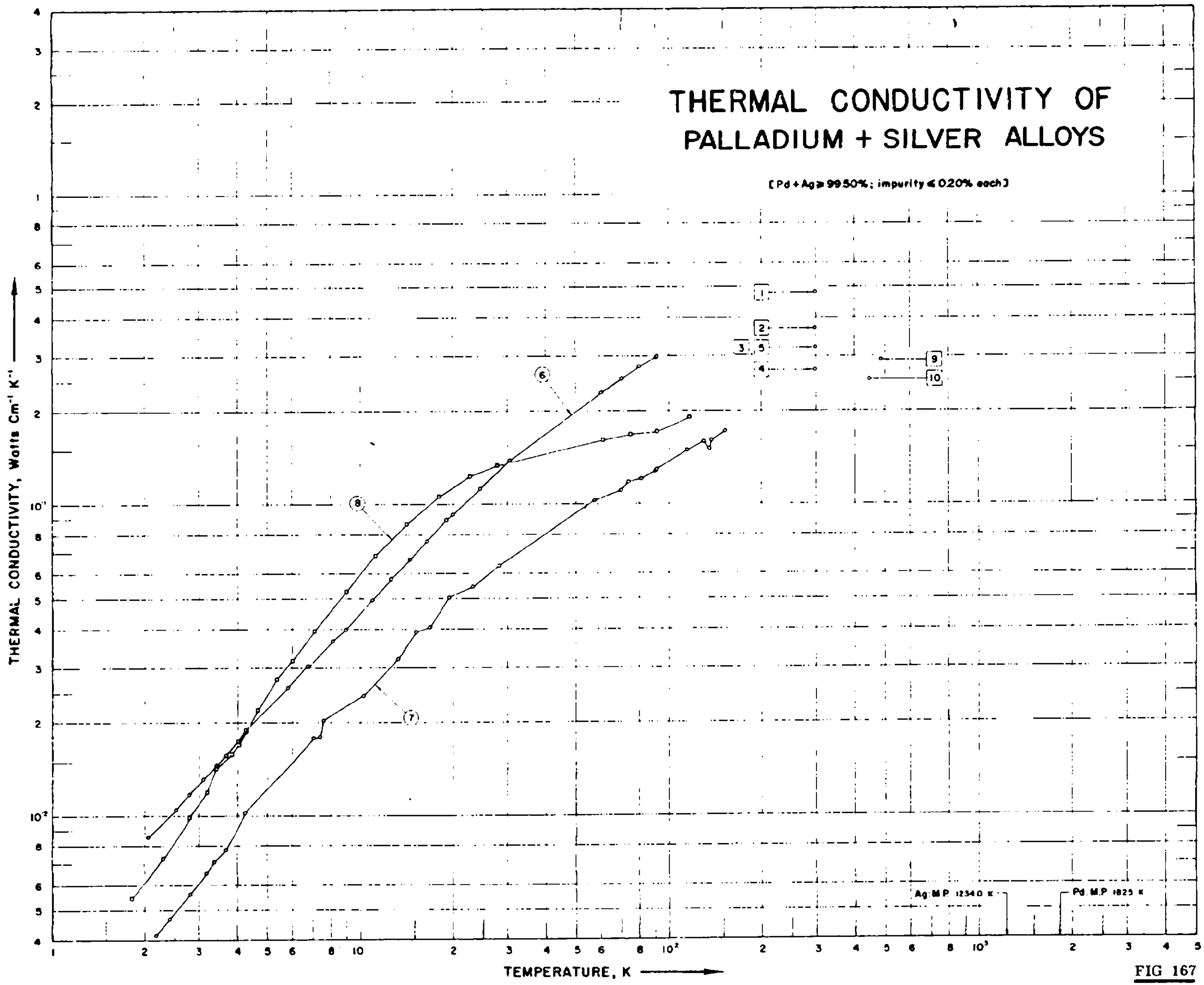

THERMAL CONDUCTIVITY OF
PALLADIUM + SILVER ALLOYS
[Pd + Ag ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Ag M.P. 1234.0 K
Pd M.P. 1825 K
1
2
3
4
5
6
7
8
9
10

FIG 167

SPECIFICATION TABLE NO. 167 THERMAL CONDUCTIVITY OF [PALLADIUM + SILVER] ALLOYS

(Pd + Ag ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 167]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pd	Ag	Composition (continued), Specifications and Remarks
1	241	E	1911	298.2			90	10	Approx. composition; electrical conductivity 4.71 x 10^4 ohm^{-1} cm^{-1} at 25 C.
2	241	E	1911	298.2			80	20	Approx. composition; electrical conductivity 3.21 x 10^4 ohm^{-1} cm^{-1} at 25 C.
3	241	E	1911	298.2			70	30	Approx. composition; electrical conductivity 2.56 x 10^4 ohm^{-1} cm^{-1} at 25 C.
4	241	E	1911	298.2			60	40	Approx. composition; electrical conductivity 2.38 x 10^4 ohm^{-1} cm^{-1} at 25 C.
5	241	E	1911	298.2			50	50	Approx. composition; electrical conductivity 3.03 x 10^4 ohm^{-1} cm^{-1} at 25 C.
6	240	L	1956	2.1-92			95	5	Specimen supplied by Johnson-Matthey and Co., Ltd.; annealed at 880 C; ρ_0 = 5.81 μohm cm; electrical resistivity 16.8 μohm cm at 293 K.
7	240	L	1956	2.2-152			70	30	Similar to the above specimen except ρ_0 = 35.6 μohm cm; electrical resistivity 40.9 μohm cm at 293 K.
8	240	L	1956	1.8-117			50	50	Similar to the above specimen except ρ_0 = 27.7 μohm cm; electrical resistivity 30.5 μohm cm at 293 K.
9	390	P	1956	486.7			75	25	
10	390	P	1956	448.2			50	50	

DATA TABLE NO. 167 THERMAL CONDUCTIVITY OF [PALLADIUM + SILVER] ALLOYS

(Pd + Ag ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

CURVE 1

T	k
298.0	0.480

CURVE 2

T	k
298.0	0.370

CURVE 3

T	k
298.0	0.320

CURVE 4

T	k
298.0	0.270

CURVE 5

T	k
298.0	0.320

CURVE 6

T	k
2.034	0.00856
2.[illegible]	0.01051
2.[illegible]70	0.01165
3.077	0.01305
3.423	0.01464
3.657	0.01566
4.013	0.0175
4.259	0.01891
5.82	0.0260
6.74	0.0304
6.82	0.0303
8.13	0.0366
8.94	0.0399
10.99	0.0495
12.63	0.0579
14.59	0.0665
16.49	0.0761
19.03	0.0893
20.30	0.0929
24.45	0.1126
30.46	0.1385
60.55	0.229
70.36	0.254
80.25	0.277

CURVE 6(cont.)

T	k
90.99	0.297
91.50	0.299

CURVE 7

T	k
2.181	0.00413
2.418	0.00470
2.805	0.00563
3.169	0.00655
3.374	0.00708
3.659	0.00775
4.256	0.0102
7.06	0.0178
7.41	0.0180
7.59	0.0203
10.15	0.0245
13.27	0.0320
15.07	0.0392
16.81	0.0405
19.35	0.0503
23.09	0.0544
28.24	0.0635
57.45	0.103
70.04	0.111
73.94	0.118
81.29	0.121
91.23	0.130
90.8	0.128
114.5	0.150
137.1	0.161
129.7	0.160
136.2	0.151
151.6	0.173

CURVE 8

T	k
1.811	0.00546
2.315	0.00725
2.823	0.00991
3.179	0.0119
3.434	0.0134
3.833	0.0159
4.017	0.0171
4.277	0.0188

CURVE 8(cont.)

T	k
4.65	0.0220
5.34	0.0276
5.99	0.0315
7.08	0.0395
8.99	0.0528
11.22	0.0684
14.17	0.0864
18.0	0.1056
22.64	0.124
27.65	0.134
61.48	0.162
75.6	0.168
91.3	0.172
117.2	0.191

CURVE 9

T	k
486.7	0.293

CURVE 10

T	k
448.2	0.251

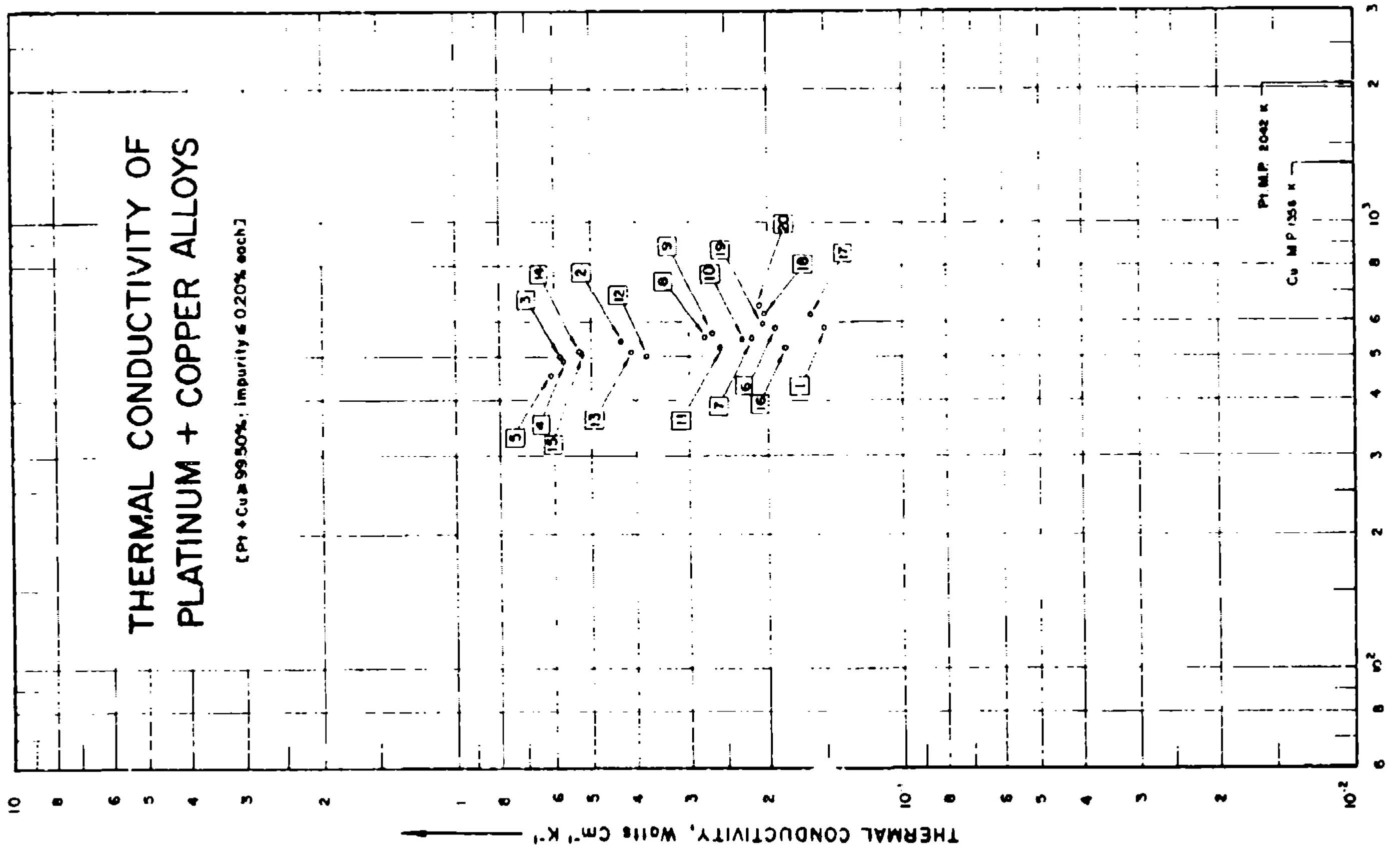

THERMAL CONDUCTIVITY OF
PLATINUM + COPPER ALLOYS
[Pt + Cu ≥ 99.50%; Impurity ≤ 0.20% each]
Pt M.P. 2042 K
Cu M.P. 1356 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 168

SPECIFICATION TABLE NO. 168 THERMAL CONDUCTIVITY OF [PLATINUM + COPPER] ALLOYS

($Pt + Cu \geq 99.50\%$; impurity $\leq 0.20\%$ each)

[For Data Reported in Figure and Table No. 168]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pt	Cu	Composition (continued), Specifications and Remarks
1	232	L	1957	586.2			75.43	24.57	Cast.
2	232	L	1957	544.2			75.43	24.57	The above specimen after 10 hrs annealing.
3	232	L	1957	502.7			75.43	24.57	The above specimen after 15 hrs annealing.
4	232	L	1957	490.2			75.43	24.57	The above specimen after 50 hrs annealing.
5	232	L	1957	458.2			75.43	24.57	The above specimen after 100 hrs annealing.
6	232	L	1957	583.7			85.08	14.92	Cast.
7	232	L	1957	552.7			85.08	14.92	The above specimen after 10 hrs annealing.
8	232	L	1957	556.2			85.08	14.92	The above specimen after 20 hrs annealing.
9	232	L	1957	570.2			85.08	14.92	The above specimen after 50 hrs annealing.
10	232	L	1957	549.2			85.08	14.92	The above specimen after 100 hrs annealing.
11	232	L	1957	529.7			50.58	49.42	Cast.
12	232	L	1957	505.2			50.58	49.42	The above specimen after 5 hrs annealing.
13	232		1957	518.2			50.58	49.42	The above specimen after 10 hrs annealing.
14	232	L	1957	519.2			50.58	49.42	The above specimen after 20 hrs annealing.
15	232	L	1957	511.2			50.58	49.42	The above specimen after 100 hrs annealing.
16	232	L	1957	529.2			62.31	37.69	Cast.
17	232	L	1957	626.2			62.31	37.69	The above specimen after 10 hrs annealing.
18	232	L	1957	623.7			62.31	37.69	The above specimen after 20 hrs annealing.
19	232	L	1957	594.2			62.31	37.69	The above specimen after 40 hrs annealing.
20	232	L	1957	654.2			62.31	37.69	The above specimen after 50 hrs annealing.

DATA TABLE NO. 168 THERMAL CONDUCTIVITY OF [PLATINUM + COPPER] ALLOYS

(Pt + Cu ≥ 99.50%; Impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		CURVE 11	
586.2	0.151	529.7	0.259
CURVE 2		CURVE 12	
544.2	0.431	505.2	0.377
CURVE 3		CURVE 13	
502.7	0.586	518.2	0.410
CURVE 4		CURVE 14	
490.2	0.573	519.2	0.531
CURVE 5		CURVE 15	
458.2	0.615	511.2	0.527
CURVE 6		CURVE 16	
583.7	0.192	529.2	0.184
CURVE 7		CURVE 17	
552.7	0.218	626.2	0.163
CURVE 8		CURVE 18	
556.2	0.280	628.7	0.205
CURVE 9		CURVE 19	
570.2	0.272	594.2	0.205
CURVE 10		CURVE 20	
549.2	0.230	654.2	0.209

SPECIFICATION TABLE NO. 169 THERMAL CONDUCTIVITY OF (PLATINUM + GOLD) ALLOYS

(Pt + Au ≥ 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pt	Au	Composition (continued), Specifications and Remarks
1	151		1930	291.2			54.75	44.25	Calculated composition; tempered at 800 C and quenched, then rolled and drawn.
2	151		1930	291.2			74.81	25.19	Similar to the above specimen.
3	151		1930	291.2			89.90	10.10	Similar to the above specimen.
4	451		1930	291.2			95.96	4.04	Similar to the above specimen.

DATA TABLE NO. 169 THERMAL CONDUCTIVITY OF (PLATINUM + GOLD) ALLOYS

(Pt + Au ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
291.2	0.21
CURVE 2*	
291.2	0.24
CURVE 3*	
291.2	0.35
CURVE 4*	
291.2	0.46

* No graphical presentation

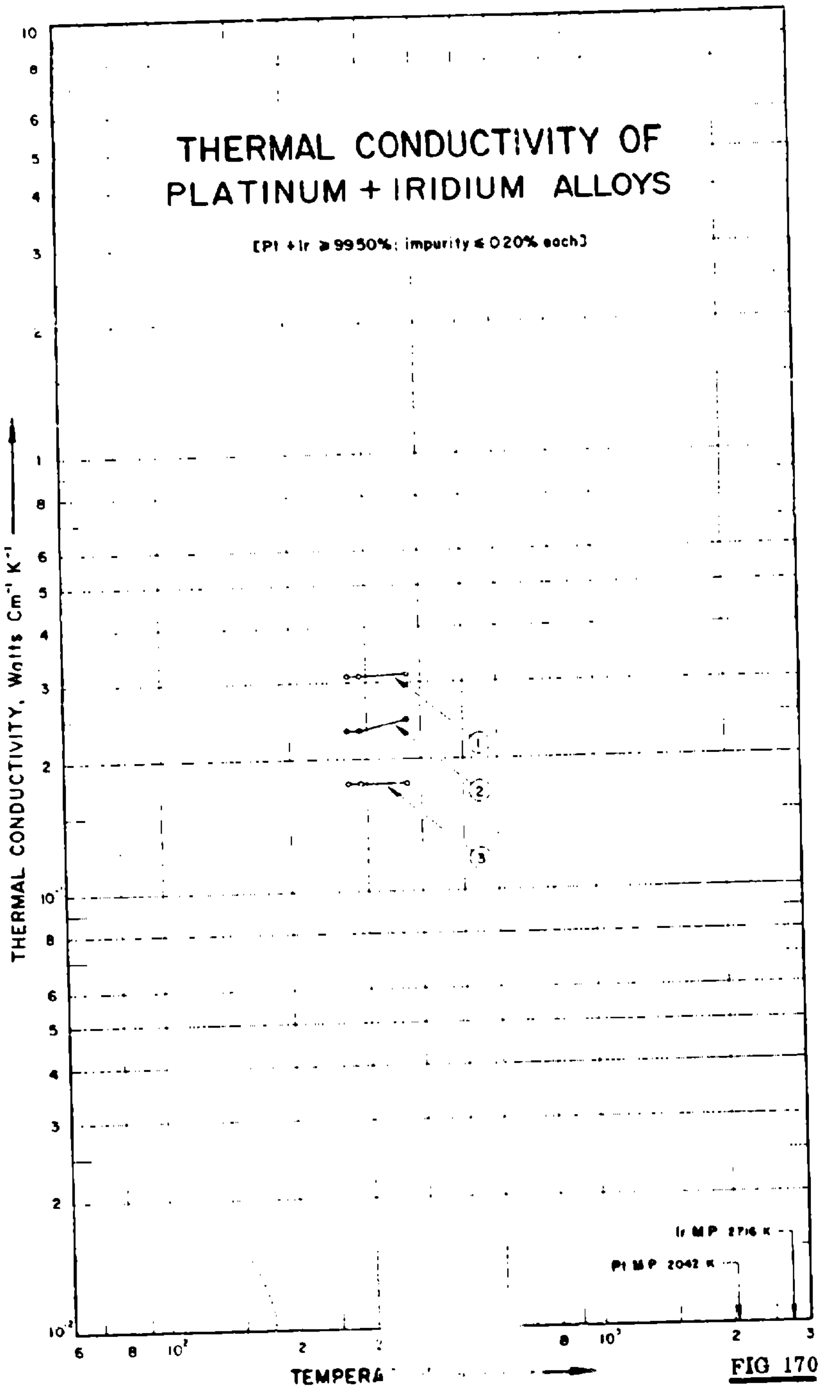

THERMAL CONDUCTIVITY OF
PLATINUM + IRIDIUM ALLOYS
[Pt + Ir ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERA
Ir M.P. 2716 K
Pt M.P. 2042 K
1
2
3

FIG 170

SPECIFICATION TABLE NO. 170 THERMAL CONDUCTIVITY OF [PLATINUM + IRIDIUM] ALLOYS

(Pt + Ir: 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 170]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pt	Ir	Composition (continued), Specifications and Remarks
1	8	F	1914	273-373		1	96	10	Approx. composition; electrical conductivity 3.98, 3.53 x 10^4 ohm^{-1} cm^{-1} at 273 and 373 C, respectively.
2	8	F	1914	273-373		2	85	15	Approx. composition; electrical conductivity 3.49, 3.19 x 10^4 ohm^{-1} cm^{-1} at 273 and 373 C, respectively.
3	8	F	1914	273-373		3	80	20	Approx. composition; electrical conductivity 3.02, 2.[illegible]1 x 10^4 ohm^{-1} cm^{-1} at 273 and 373 C, respectively.

DATA TABLE NO. 170 THERMAL CONDUCTIVITY OF [PLATINUM + IRIDIUM] ALLOYS

(Pt + Ir ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
273.2	0.310
290.2	0.310
373.2	0.314
CURVE 2	
273.2	0.234
290.2	0.234
373.2	0.247
CURVE 3	
273.2	0.176
290.2	0.176
373.2	0.176

SPECIFICATION TABLE NO. 171 THERMAL CONDUCTIVITY OF [PLATINUM + PALLADIUM] ALLOYS

(Pt + Pd ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pt	Pd	Composition (continued), Specifications and Remarks
1	241	E	1911	298.2			50	50	Approx composition; electrical conductivity 3.79×10^4 $ohm^{-1}cm^{-1}$ at 25 C.
2	241	E	1911	298.2			60	40	Approx composition; electrical conductivity 3.69×10^4 $ohm^{-1}cm^{-1}$ at 25 C.
3	241	E	1911	298.2			70	30	Approx composition; electrical conductivity 3.80×10^4 $ohm^{-1}cm^{-1}$ at 25 C.
4	241	E	1911	298.2			80	20	Approx composition; electrical conductivity 4.17×10^4 $ohm^{-1}cm^{-1}$ at 25 C.
5	241	E	1911	298.2			90	10	Approx composition; electrical conductivity 5.20×10^4 $ohm^{-1}cm^{-1}$ at 25 C.

DATA TABLE NO. 171 THERMAL CONDUCTIVITY OF [PLATINUM + PALLADIUM] ALLOYS

(Pt + Pd ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 4*	
298.2	0.379	298.2	0.42
CURVE 2*		CURVE 5*	
298.2	0.340	298.2	0.43
CURVE 3*			
298.2	0.360		

* No graphical presentation

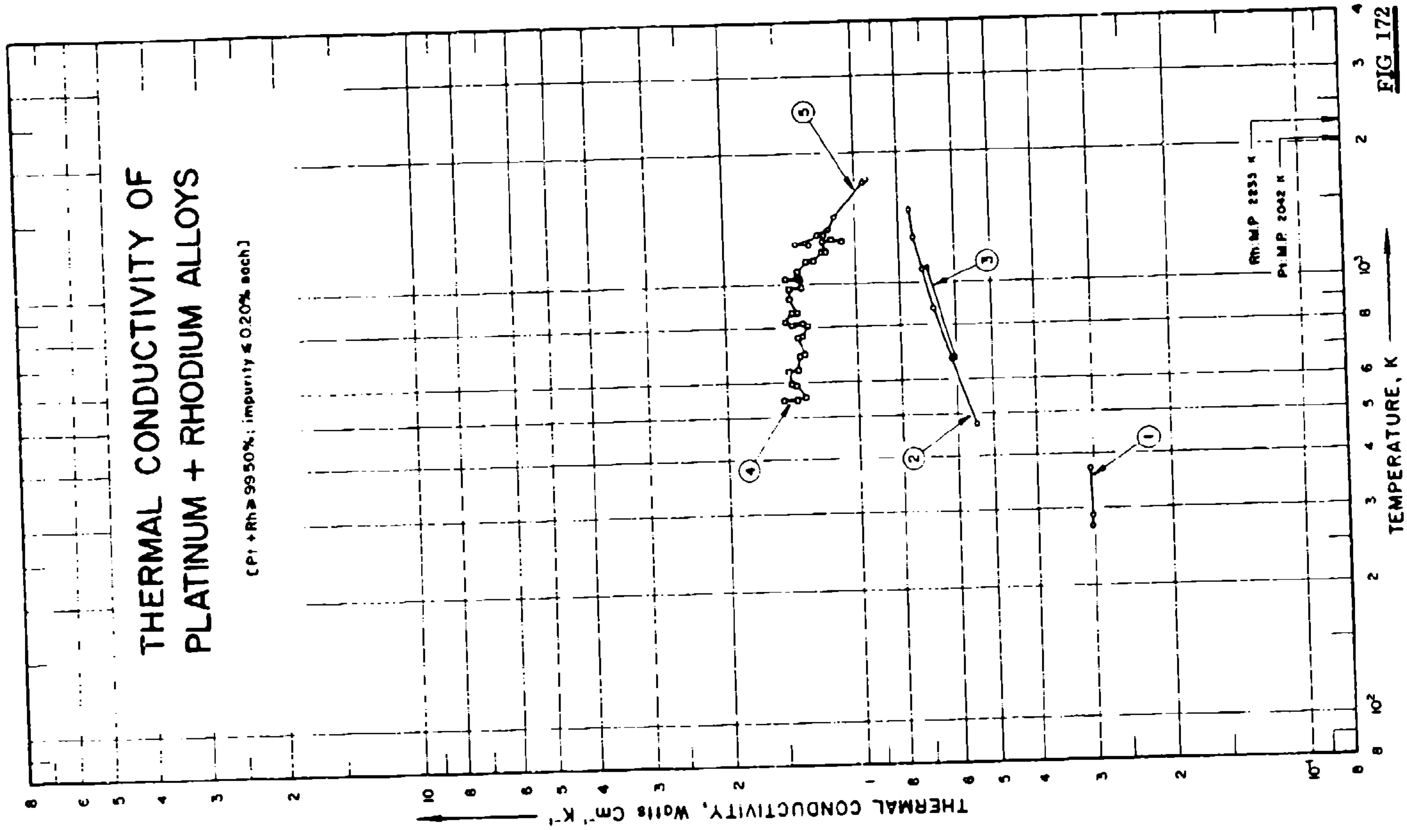

THERMAL CONDUCTIVITY OF
PLATINUM + RHODIUM ALLOYS
[Pt + Rh ≥ 99.50%; impurity ≤ 0.20% each]
Rh: M.P. 2233 K
Pt: M.P. 2042 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
1
2
3
4
5

FIG 172

SPECIFICATION TABLE NO. 172 THERMAL CONDUCTIVITY OF PLATINUM + RHODIUM ALLOYS

(Pt + Rh ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 172]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pt	Rh	Composition (continued), Specifications and Remarks
1	8	E	1914	273-373			90	10	Specimen 0.1018 cm in dia and 35.1 cm long. 22.45 and ~~22.45 μohm cm~~ electrical resistivity 25.49 μohm cm at ~~100 C~~ 0 and 100C, respectively.
2	596	L	1962	473-1473			60	40	0.01 - 0.1 Fe, 0.001 - 0.01 Cu, Ir, Pd, Si and Zr each, 0.001 each B and Ca; machined and then annealed at 1000 C; specimen in the form of right cylinder of 2.539 cm in dia and 7.5 cm long; the solid portion of the cylinder 6.49 cm in length.
3	596	L	1962	673-1073			60	40	Similar to the above specimen; measured as the temperature decreases.
4	589	R	1962	548-1254			60	40	1 in. outside dia and 0.25 in. inside dia discs punched from 0.04 in. thick sheet and stacked to 1 in. high; annealed at 982 C for 30 min; grain size increase by 2 to 3 times after the measurement.
5	589	R	1962	1240-1747			60	40	The second run of the above specimen.

DATA TABLE NO. 172 THERMAL CONDUCTIVITY OF [PLATINUM + RHODIUM] ALLOYS

(Pt + Rh 99.50%, impurity 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		**CURVE 4 (cont.)**	
273.2	0.301	927.1	1.40*
290.2	0.301	984.3	1.42
373.2	0.305	985.4	1.41*
		985.9	1.34
CURVE 2		1023.7	1.35
		1026.5	1.15
473.2	0.543	1027.1	1.36
673.2	0.615	1079.3	1.36
873.2	0.672	1080.4	1.34*
1073.2	0.710	1082.1	1.35*
1273.2	0.745	1132.1	1.30
1473.2	0.755	1134.3	1.25
		1198.2	1.20
CURVE 3		1198.2	1.17
		1200.9	1.20*
673.2	0.609	1253.7	1.19
1073.2	0.693	1253.7	1.08
		1254.3	1.14
CURVE 4			
		CURVE 5	
547.6	1.38		
547.6	1.48	1240.4	1.28
549.8	1.32	1241.5	1.37
590.9	1.39	1300.4	1.18
591.5	1.41	1300.4	1.22
638.2	1.44	1300.4	1.19*
638.7	1.37	1340.9	1.15
690.4	1.36*	1349.3	1.16*
690.4	1.38	1349.3	1.15*
691.5	1.32	1437.6	1.12
760.4	1.37	1437.6	1.14*
763.7	1.34	1445.9	1.11*
763.7	1.36*	1451.5	1.13*
808.7	1.30	1710.9	0.952
809.8	1.41	1733.2	0.940*
809.8	1.33	1747.1	0.966*
825.9	1.46		
866.5	1.40		
866.5	1.37		
925.4	1.42		

*Not shown on plot

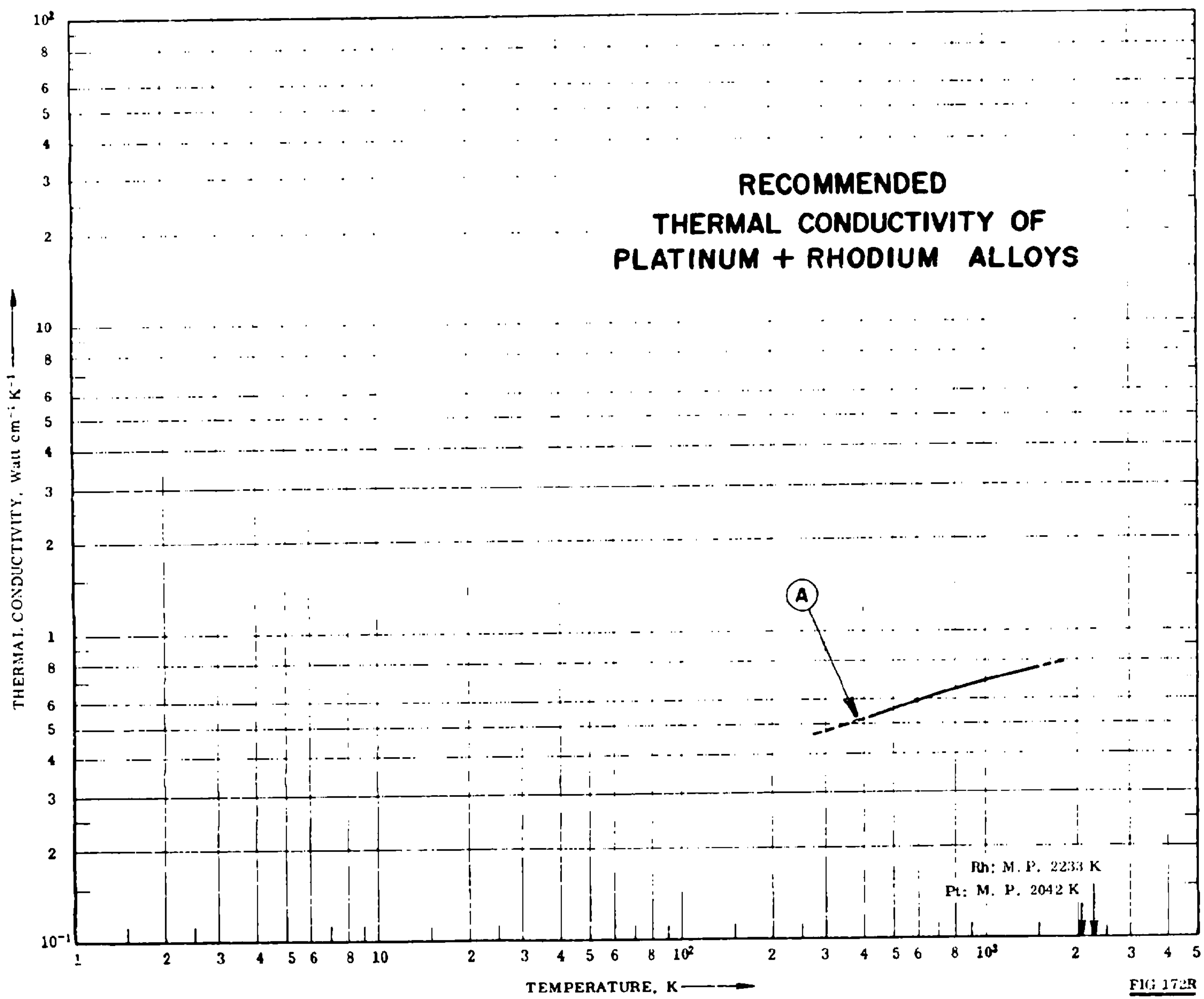

RECOMMENDED
THERMAL CONDUCTIVITY OF
PLATINUM + RHODIUM ALLOYS
A
Rh: M. P. 2233 K
Pt: M. P. 2042 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 172R

SPECIFICATION TABLE NO. 172R RECOMMENDED THERMAL CONDUCTIVITY OF [PLATINUM + RHODIUM] ALLOYS

[For Data Reported in Figure and Data Table No. 172R]

Curve No.	Name and Designation	Nominal Composition (weight percent) and Remarks	Estimated Error
A		60 Pt and 40 Rh; well annealed	± 5% from 500 to 1000 K and ±5 to ±10% below 500 K and above 1000 K.

DATA TABLE NO. 172R RECOMMENDED THERMAL CONDUCTIVITY OF [PLATINUM + RHODIUM] ALLOYS

[Temperature, T_1 in K and T_2 in F; Thermal Conductivity, k_1 in Watt $cm^{-1} K^{-1}$ and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$]

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
	CURVE A				CURVE A (cont.)		
273.2	(0.464)‡	(26.8)	32.0	1500	(0.758)	(43.8)	2240
300	(0.467)	(27.0)	80.3	1600	(0.768)	(44.4)	2420
350	(0.497)	(28.7)	170.3	1700	(0.778)	(45.0)	2600
400	(0.516)	(29.8)	260.3	1800	(0.787)	(45.5)	2780
500	0.555	32.1	440.3				
600	0.589	34.0	620.3				
700	0.623	36.0	800.3				
800	0.650	37.6	980.3				
900	0.672	38.8	1160				
1000	0.692	40.0	1340				
1100	0.711	41.1	1520				
1200	0.727	42.0	1700				
1300	0.738	42.6	1880				
1400	0.748	43.2	2060				

‡ Values in parentheses are extrapolated.

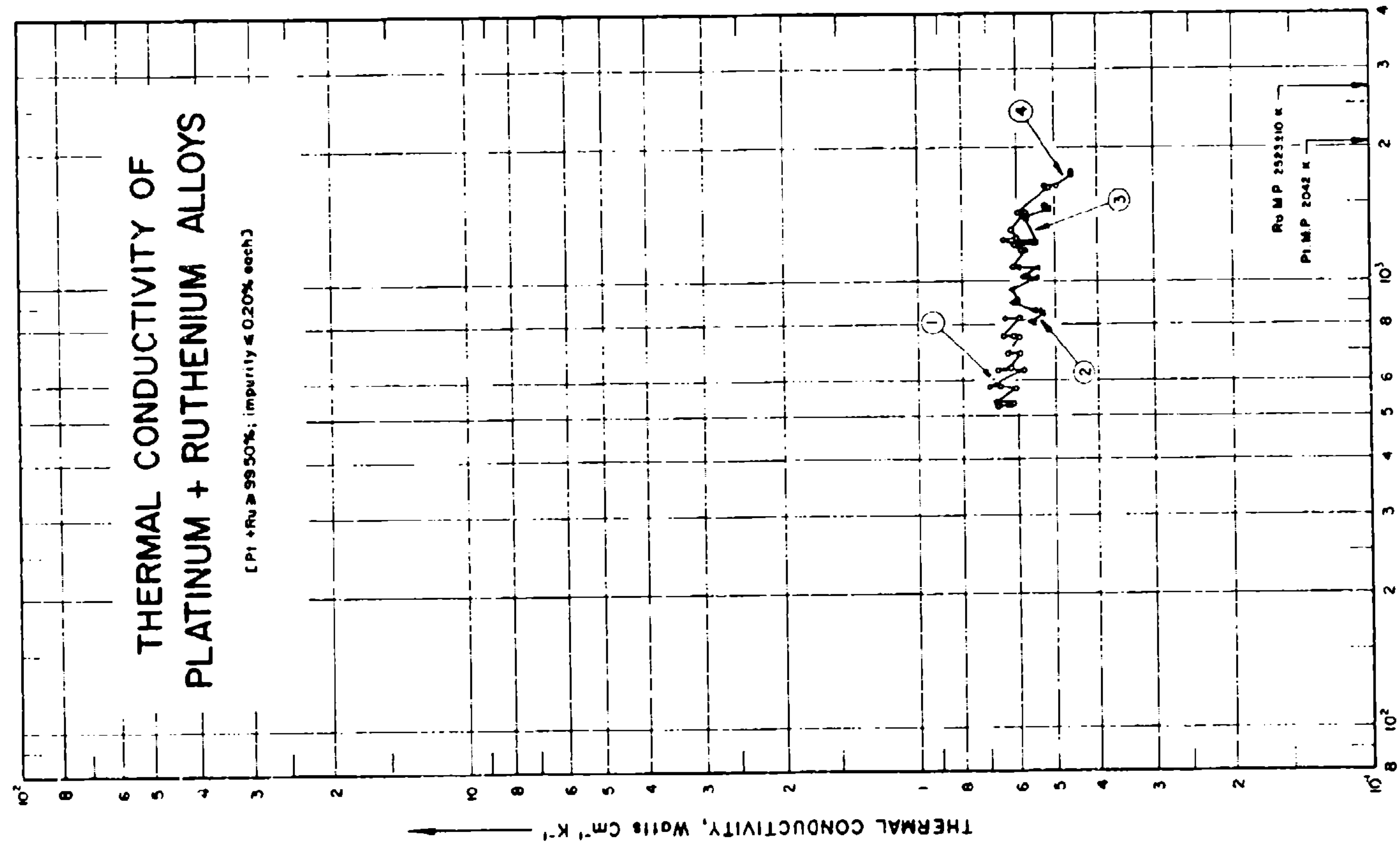

THERMAL CONDUCTIVITY OF
PLATINUM + RUTHENIUM ALLOYS
[Pt + Ru ≥ 99.50%; impurity ≤ 0.20% each]
Ru M.P. 2523±10 K
Pt M.P. 2042 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 173

SPECIFICATION TABLE NO. 173 THERMAL CONDUCTIVITY OF [PLATINUM + RUTHENIUM] ALLOYS

[Pt + Ru > 99.50%; impurity < 0.20% each]

[For Data Reported in Figure and Table No. 173]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pt	Ru	Composition (continued), Specifications and Remarks
1	589	R	1962	528-826			95	5	Specimen prepared by stacking 1 in. O.D. and 0.25 in. I.D. discs punched from a 0.040 in. thick sheet to a thickness of 1 in.; annealed at 982 C for 30 min; grain size increased by 2 to 3 times after the measurement.
2	589	R	1962	808-1089			95	5	The second run of the above specimen.
3	589	R	1962	1221-1472			95	5	The third run of the above specimen.
4	589	R	1962	1072-1763			95	5	The fourth run of the above specimen.

DATA TABLE NO. 173 THERMAL CONDUCTIVITY OF [PLATINUM + RUTHENIUM] ALLOYS

[Pt + Ru > 99.50%; impurity < 0.20% each]

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

CURVE 1

T	k
527.6	0.663
530.4	0.626
531.5	0.619
533.7	0.765
580.4	0.610
581.5	0.659
582.1	0.694
634.3	0.584
634.3	0.665
634.8	0.622
690.4	0.594
690.9	0.590*
690.9	0.630
750.9	0.597
752.1	0.614
754.8	0.648
824.3	0.597
824.8	0.580
824.8	0.596*
825.9	0.601*
825.9	0.640*

CURVE 2

T	k
808.2	0.557
810.4	0.562
813.7	0.571*
850.4	0.531
852.1	0.522*
854.3	0.537
855.9	0.521*
857.6	0.551
899.8	0.613
900.9	0.614*
903.2	0.600
959.8	0.616
961.5	0.623*
962.1	0.627*
1015.4	0.544
1018.2	0.548*
1018.7	0.571
1021.5	0.573*
1023.7	0.588
1078.7	0.544
1083.2	0.547*
1088.7	0.600

CURVE 3

T	k
1221.1	0.565
1222.1	0.590
1222.1	0.587
1222.1	0.550
1395.4	0.574
1395.4	0.568*
1395.4	0.583*
1463.2	0.511
1471.5	0.524

CURVE 4

T	k
1072.1	0.610
1072.1	0.593*
1082.1	0.610*
1183.2	0.577
1189.3	0.588
1211.5	0.606
1227.6	0.584*
1247.1	0.599*
1249.8	0.643
1249.8	0.639
1256.2	0.603
1314.8	0.619
1314.8	0.614
1427.6	0.575
1427.6	0.594
1623.7	0.513
1635.9	0.524
1635.9	0.492
1738.2	0.459
1763.2	0.459

* Not shown on plot

SPECIFICATION TABLE NO. 174 THERMAL CONDUCTIVITY OF [PLATINUM + SILVER] ALLOYS

(Pt + Ag ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pt	Ag	Composition (continued), Specifications and Remarks
1	390	L	1956	553.2			80	20	No detail reported.
2	390	L	1956	506.7			75	25	No detail reported.
3	390	L	1956	521.2			50	50	No detail reported.

DATA TABLE NO. 174 THERMAL CONDUCTIVITY OF [PLATINUM + SILVER] ALLOYS

(Pt + Ag ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
553.2	0.368
CURVE 2*	
506.7	0.289
CURVE 3*	
521.2	0.272

* No graphical presentation

SPECIFICATION TABLE NO. 175 THERMAL CONDUCTIVITY OF [PLUTONIUM + ALUMINUM] ALLOYS

(Pu + Al ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pu	Al	Composition (continued), Specifications and Remarks
1	926	C	1960	373-873	5-10	Delta-stabilized	99.0	1.0	Specimen 2 cm in dia and 5 cm long; Inconel and Armco iron used as the comparative material.

DATA TABLE NO. 175 THERMAL CONDUCTIVITY OF [PLUTONIUM + ALUMINUM] ALLOYS

(Pu + Al ≥ 99.50%; impurity ≤ 0.20% each)*

[Temperature, T, K; Thermal Conductivity, k, Watt cm⁻¹ K⁻¹]

T	k
CURVE 1*	
373.2	0.092
473.2	0.113
573.2	0.138
673.2	0.159
773.2	0.188
873.2	0.209

* No graphical presentation

SPECIFICATION TABLE NO. 176 THERMAL CONDUCTIVITY OF [PLUTONIUM + IRON] ALLOYS

(Pu + Fe > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Pu	Fe	Composition (continued), Specifications and Remarks
1	182	L	1959	473-823	5.0		90.5	9.5	Measured in vacuum of 10^{-6} mm Hg; melting point at 410 C.

DATA TABLE NO. 176 THERMAL CONDUCTIVITY OF [PLUTONIUM + IRON] ALLOYS

(Pu + Fe > 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
473.20	0.138
523.20	0.148
573.20	0.156
623.20	0.164
673.20	0.173
693.20	0.179
723.20	0.184
773.20	0.191
823.20	0.197

* No graphical presentation

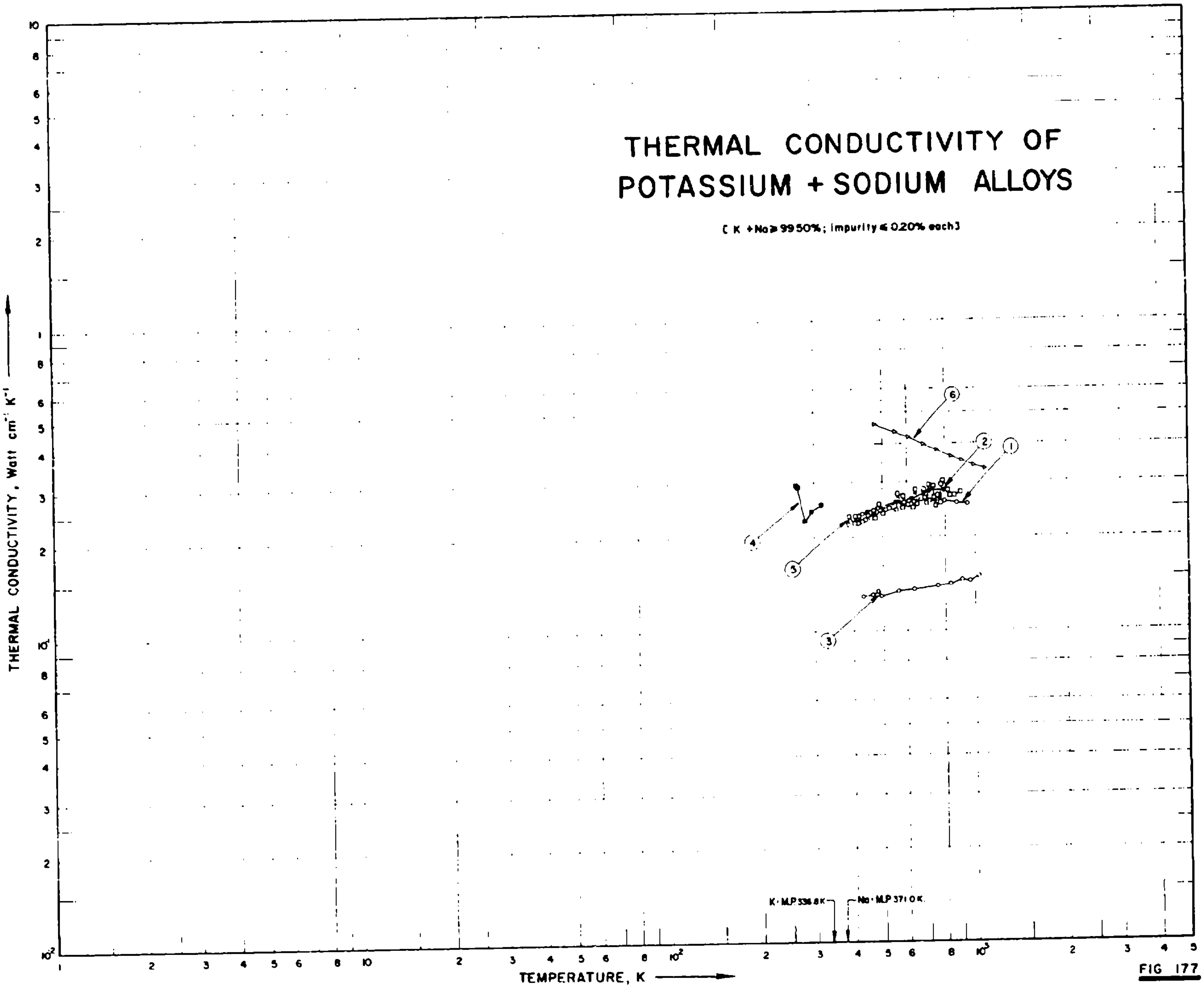

THERMAL CONDUCTIVITY OF
POTASSIUM + SODIUM ALLOYS
[K + Na ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
K · M.P. 336.8 K
Na · M.P. 371.0 K
1
2
3
4
5
6

FIG 177

SPECIFICATION TABLE NO. 177 THERMAL CONDUCTIVITY OF POTASSIUM + SODIUM ALLOYS

(K + Na 99.50%; impurity 0.20%)

[For Data Reported in Figure and Table No. 177]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) K	Na	Composition (continued), Specifications and Remarks
1	158	L	1955	430-950	1.0		77.7	22.3	Highly purified; specimen in liquid state; electrical resistivity 41.6, 44.4, 51.3, 58.8, 67.3, 77.3, and 89.2 μohm cm at 150, 200, 300, 400, 500, 600, and 700 C respectively.
2	158	L	1955	449-794	1.0		56.5	43.5	Highly purified; specimen in liquid state; electrical resistivity 47.23, 54.33, 62.21, and 69.37 μohm cm at 200, 300, 406, and 500 C respectively.
3	105	P	1956	432-1030			78.0	22.0	In liquid state.
4	72	E	1913	262-316			63.0	37.0	Very pure; sodium free from Fe, Ca, Mg, Al, and K, potassium free from Fe, Ca, Mg, and Al; supplied by Eimer and Amend; specimen 1.562 cm I.D. and 20 cm long; electrical resistivity 21.93, 22.10, 34.04, 34.11, 35.15, 35.27, 35.13, and 36.40 μohm cm at -10.6, -8.9, 5.8, 6.2, 20.7, 22.0, 22.1, and 42.9 C respectively; specimen in liquid state.
5	592	L	1959	388-899			75	25	In liquid state.
6	756, 862	-	1962	473-1073			Bal.	0.32	0.02 Fe and 0.004 O (post test); molten specimen contained in a type 347 stainless steel tube; supplied by Fisher Scientific Co.; electrical resistivity reported as 8.07, 8.24, 8.59, 8.85, 9.47, 9.83, 14.77, 15.48, 17.90, 21.86, 26.06, 29.57, 34.11, 38.32, 43.30, 48.47, 54.04, 59.47, 60.02, 66.75, and 74.30 μohm cm at 25.3, 29.4, 38.3, 51.4, 58.3, 59.2, 79.4, 91.9, 140.8, 205.4, 256.4, 313.9, 373.6, 429.2, 481.9, 542.8, 593.3, 646.9, 651.4, 706.7, and 764.2 C, respectively; thermal conductivity data calculated from measured electrical resistivity values and the Lorenz number based on the thermal conductivity data of Ewing, C.T. and Grand, J.A. (NRL Report 3835, 1951).

DATA TABLE NO. 177 THERMAL CONDUCTIVITY OF [POTASSIUM + SODIUM] ALLOYS

(K + Na ≥99.50%; impurity ≤0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k	T	k	T	k
CURVE 1		**CURVE 5**		**CURVE 5 (cont.)**		**CURVE 5 (cont.)**	
430.3	0.239	388.2	0.226	588.2	0.265*	793.2	0.277*
484.6	0.249	390.7	0.235	600.2	0.260*	797.2	0.284*
539.4	0.260	393.2	0.220*	604.7	0.266*	802.7	0.280*
637.2	0.261	406.2	0.221	605.2	0.255	808.2	0.263*
718.4	0.262	408.2	0.235	608.2	0.261*	827.7	0.282
798.7	0.261	418.2	0.221	613.2	0.250*	834.2	0.273
876.7	0.258	419.2	0.235	628.2	0.261*	856.2	0.273
949.5	0.256	425.2	0.232*	630.2	0.250	899.2	0.277
		430.2	0.225	633.2	0.263*		
CURVE 2		430.7	0.244*	641.2	0.282	**CURVE 6**	
		439.7	0.228	644.7	0.252*		
449.0	0.244	442.2	0.239*	650.0	0.264*	473.2	0.458
558.6	0.260	447.2	0.238	653.2	0.256	549.2	0.434
627.7	0.266	451.2	0.236*	664.2	0.261*	609.2	0.417
716.3	0.271	458.2	0.232	667.7	0.276*	683.2	0.398
794.2	0.271	458.7	0.244	671.2	0.260*	750.2	0.380
		463.7	0.236*	681.2	0.259*	836.2	0.362
CURVE 3		467.7	0.246	681.2	0.282*	905.2	0.350
		468.7	0.232*	685.2	0.282	990.2	0.338
432.0	0.129	474.2	0.232	687.0	0.268	1073	0.328
466.1	0.131	476.2	0.242	689.2	0.277		
482.6	0.134	479.2	0.232*	695.0	0.258		
495.5	0.129	484.2	0.242*	703.0	0.274*		
561.4	0.134	488.2	0.256	703.2	0.285*		
632.0	0.136	493.2	0.245	703.7	0.261*		
761.4	0.138	500.2	0.250*	707.2	0.291		
832.0	0.143	504.2	0.238	709.2	0.277*		
901.4	0.147	508.2	0.244*	713.2	0.284*		
960.3	0.145	514.2	0.246	715.0	0.266*		
1029.7	0.150	520.7	0.257*	723.2	0.274*		
		526.2	0.248	733.2	0.281*		
CURVE 4		522.2	0.252*	736.2	0.289		
		541.7	0.246*	738.2	0.268		
262.6	0.295	545.2	0.257*	747.2	0.273*		
264.3	0.291	555.2	0.271*	748.2	0.253		
279.0	0.229	556.7	0.245	758.2	0.286*		
279.4	0.231*	558.2	0.256*	759.2	0.272		
293.9	0.245	558.7	0.279*	767.7	0.291*		
295.2	0.244*	562.7	0.274	777.2	0.258		
295.3	0.244	575.2	0.261	780.0	0.292		
316.1	0.259	578.2	0.271	787.7	0.300		
		584.2	0.499				
		585.2	0.270				

* Not shown on plot

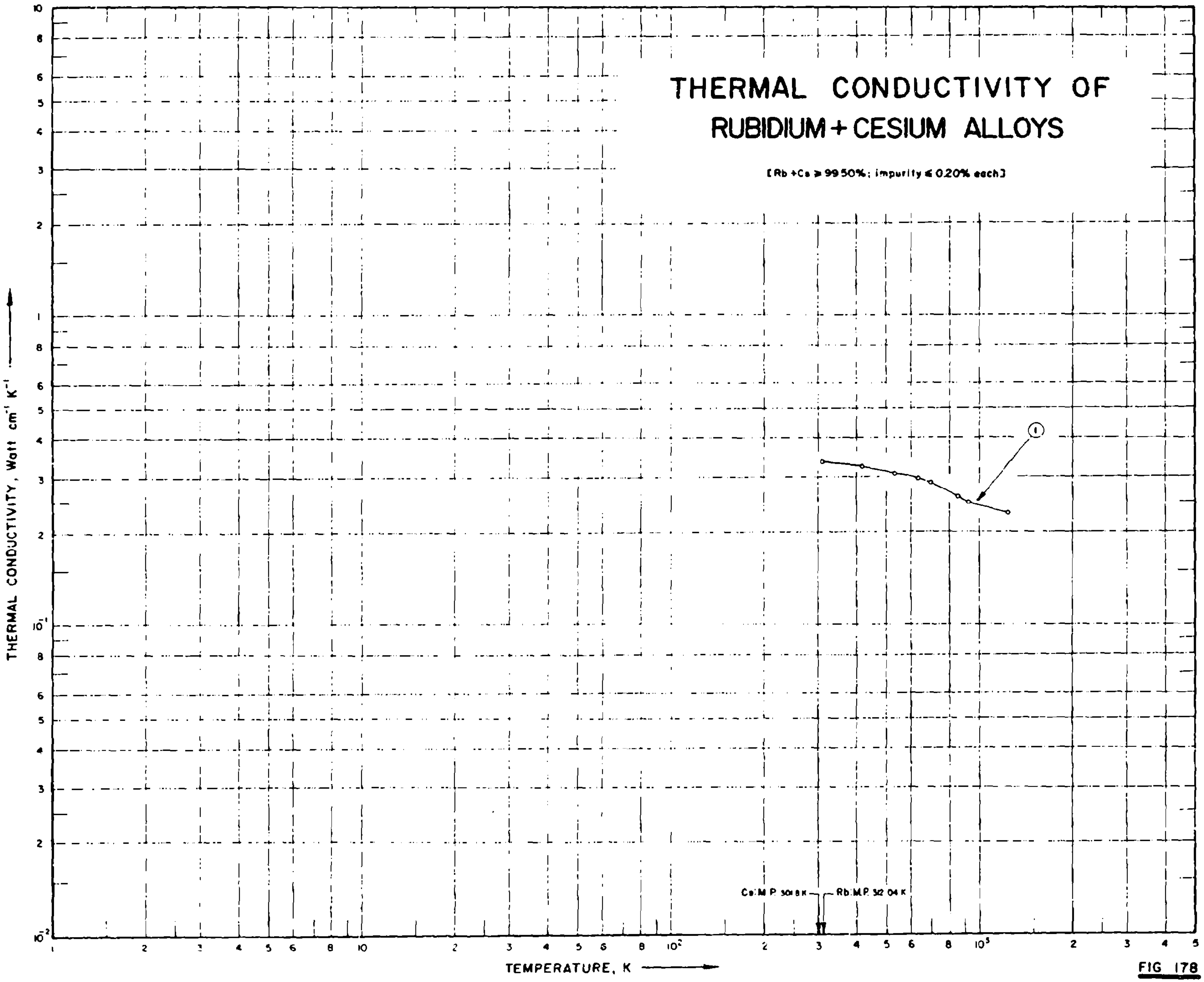

THERMAL CONDUCTIVITY OF
RUBIDIUM + CESIUM ALLOYS
[Rb + Cs ≥ 99.50%; impurity ≤ 0.20% each]
1
Cs: M.P. 301.8 K
Rb: M.P. 312.04 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 178

SPECIFICATION TABLE NO. 178 THERMAL CONDUCTIVITY OF RUBIDIUM + CESIUM ALLOYS

(Rb + Cs ≥ 99.50%, impurity ≤ 0.20% each)

For Data Reported in Figure and Table No. 178

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Rb	Cs	Composition (continued), Specifications and Remarks
1	756		1962	312-1025			Bal	0.32	0.06 K, 0.05 Na; composition after testing, 0.35 Cs, 0.13 Na, 0.11 K, 0.03 Ca, 0.008 Fe, 0.005 O, 0.002 Nb, 0.001 each of Cr and La; liquid state; contained in a type 347 stainless steel tube; obtained from American Potash and Chemical Corp; electrical resistivity reported as 11.29, 13.16, 13.85, 14.67, 22.54, 22.93, 23.35, 25.96, 31.62, 37.06, 42.30, 46.59, 46.61, 52.45, 58.01, 59.37, 64.61, 71.48, 72.49, 81.06, 91.29, 99.05, and 109.31 μohm cm at 0, 25.0, 25.6, 37.5, 39.2, 41.7, 46.4, 91.7, 146.7, 204.2, 260.3, 308.3, 309.4, 361.7, 412.5, 426.1, 463.1, 520.3, 528.9, 581.7, 650.1, 697.2, and 751.7 C, respectively; thermal conductivity data calculated from measured electrical resistivity values and the Lorenz number 2.45×10^{-8} W ohm K^{-2}.

DATA TABLE NO. 178 THERMAL CONDUCTIVITY OF [RUBIDIUM + CESIUM] ALLOYS

(Rb + Cs ≥99.50%; impurity ≤0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
312.4	0.335
419.9	0.325
533.5	0.309
634.9	0.297
699.3	0.289
854.9	0.258
923.3	0.248
1025	0.230

SPECIFICATION TABLE NO. 179 THERMAL CONDUCTIVITY OF (SELENIUM + BROMINE) ALLOYS

(Se + Br > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Se	Br	Composition (continued), Specifications and Remarks
1	358	L	1957	300.7	< 4.0		99.5	0.5	Vitreous and amorphous.
2	358	L	1957	293.2	< 4.0		99.5	0.5	Hexagonal crystal.
3	358	L	1957	293.2	< 4.0		99.75	0.25	Hexagonal crystal.

DATA TABLE NO. 179 THERMAL CONDUCTIVITY OF (SELENIUM + BROMINE) ALLOYS

(Se + Br > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
300.7	0.0101
CURVE 2*	
293.2	0.0247
CURVE 3*	
293.2	0.0220

* No graphical presentation

SPECIFICATION TABLE NO. 186 THERMAL CONDUCTIVITY OF [SELENIUM + CADMIUM] ALLOYS

(Se + Cd ≥ 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Se	Cd	Composition (continued), Specifications and Remarks
1	898	L	1966	293-315	3-5	B-5	99.5	0.5	Amorphous specimen prepared from the melt of 99.99999 pure selenium by rapid cooling in vacuum; doped with cadmium.
2	898	L	1966	293-315	3-5	B-5	99.0	1.0	Similar to the above specimen.

DATA TABLE NO. 186 THERMAL CONDUCTIVITY OF [SELENIUM + CADMIUM] ALLOYS

(Se + Cd ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 2*	
292.6	0.00437	292.6	0.00456
294.5	0.00444	294.6	0.00466
296.2	0.00456	296.4	0.00474
298.6	0.00470	299.4	0.00493
300.1	0.00484	300.4	0.00498
301.6	0.00490	299.4	0.00509
303.6	0.00505	303.4	0.00520
305.3	0.00516	304.8	0.00531
306.0	0.00525	306.4	0.00566
306.2	0.00628	306.8	0.00493
307.4	0.00558	308.3	0.00523
308.9	0.00594	309.8	0.00536
310.3	0.00616	311.8	0.00608
311.2	0.00637	315.1	0.00686
313.0	0.00667		
315.0	0.00706		

* No graphical presentation

SPECIFICATION TABLE NO. 1-1 [illegible]RMAL CONDUCTIVITY OF [SELENIUM + CHLORINE] ALLOYS

(Se + Cl 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Se	Cl	Composition (continued), Specifications and Remarks
1	361	L	1957	294.2		No. 1	99.75	0.25	Amorphous.
2	361	L	1957	294.2		No. 2	99.75	0.25	Crystalline form prepared from vitreous form by heating at 130 C for 40 min.
3	361	L	1957	294.2		No. 3	99.75	0.25	Crystalline form prepared from vitreous form by heating at 200 C for 40 min.
4	362	L	1957	291.7		No. 8	99.75	0.250	Amorphous.
5	362	L	1957	291.7		No. 9	99.50	0.50	Amorphous.
6	362	L	1957	291.7		No. 10	99.0	1.0	Amorphous.

DATA TABLE NO. 1-1 THERMAL CONDUCTIVITY OF [SELENIUM + CHLORINE] ALLOYS

(Se + Cl 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm⁻¹ K⁻¹]

T	k	T	k
CURVE 1*		CURVE 4*	
294.2	0.00858	291.7	0.00837
CURVE 2*		CURVE 5*	
294.2	0.0253	291.7	0.00858
CURVE 3*		CURVE 6*	
294.2	0.0253	291.7	0.00987

* No graphical presentation

SPECIFICATION TABLE NO. 182 THERMAL CONDUCTIVITY OF (SELENIUM + IODINE) ALLOYS

(Se + I ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Se	I	Composition (continued), Specifications and Remarks
1	364	L	1957	299.2			99.757	0.243	Amorphous.
2	364	L	1957	299.2			99.757	0.243	Crystalized at 214 C from vitreous form.
3	364	L	1957	299.2			99.466	0.534	Amorphous.
4	364	L	1957	299.2			99.466	0.534	Crystalized at 214 C from vitreous form.
5	364	L	1957	299.2			99.223	0.777	Amorphous.
6	364	L	1957	299.2			99.223	0.777	Crystalized at 214 C from vitreous form.
7	364	L	1957	299.2			99.077	0.923	Amorphous.
8	364	L	1957	299.2			99.077	0.923	Crystalized at 214 C from vitreous form.
9	364	L	1957	299.2			98.743	1.257	Amorphous.
10	364	L	1957	299.2			98.743	1.257	Crystalized at 214 C from vitreous form.
11	364	L	1957	299.2			98.615	1.385	Amorphous.
12	364	L	1957	299.2			98.615	1.385	Crystalized at 214 C from vitreous form.

DATA TABLE NO. 182 THERMAL CONDUCTIVITY OF (SELENIUM + IODINE) ALLOYS

(Se + I ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k	T	k	T	k	T	k	T	k	T	k
CURVE 1*		CURVE 3*		CURVE 5*		CURVE 7*		CURVE 9*		CURVE 11*	
299.2	0.00883	299.2	0.00916	299.2	0.00941	299.2	0.00979	299.2	0.0111	299.2	0.0115
CURVE 2*		CURVE 4*		CURVE 6*		CURVE 8*		CURVE 10*		CURVE 12*	
299.2	0.0229	299.2	0.0234	299.2	0.0244	299.2	0.0273	299.2	0.0290	299.2	0.0298

* No graphical presentation

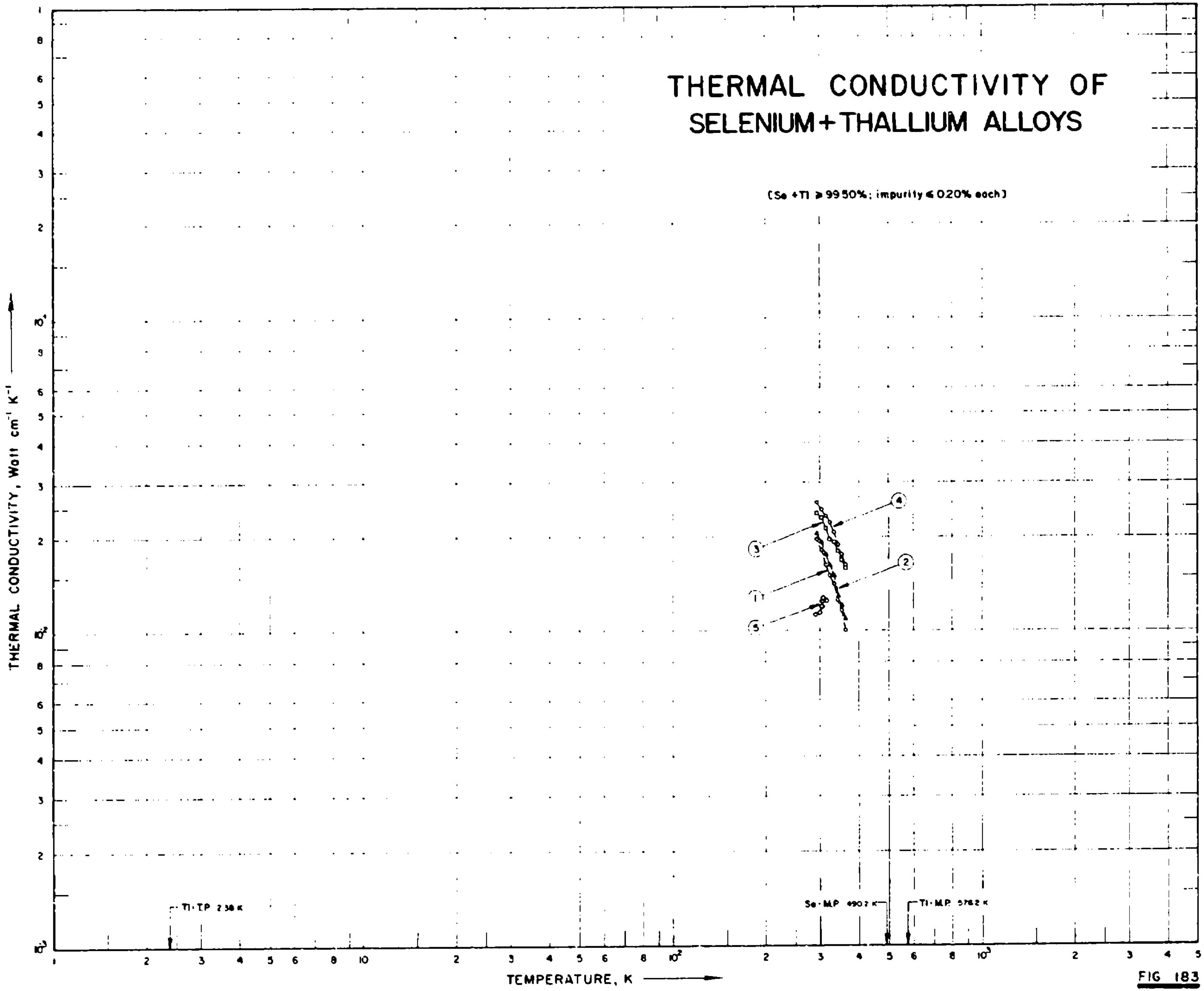

THERMAL CONDUCTIVITY OF
SELENIUM+THALLIUM ALLOYS
(Se+Tl ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Tl: TP 238 K
Se: M.P. 490.2 K
Tl: M.P. 576.2 K
1
2
3
4
5

FIG 183

SPECIFICATION TABLE NO. 183 THERMAL CONDUCTIVITY OF [SELENIUM + THALLIUM] ALLOYS

(Se + Tl ≥ 99.50%; impurity ≤ 0.20%)

[For Data Reported in Figure and Table No. 183]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent)		Composition (continued), Specifications and Remarks
1	522	L	1961	293-363			99.5	0.5	Polycrystal; prepared by fusing Se (99.996 pure) and Tl_2Se in 10^{-4} mm Hg vacuo; specimen 16 mm dia, 8-10 mm thick disk; annealed at 110 and 210 C for 1 hr.
2	522	L	1961	293-363			99.25	0.75	Similar to the above specimen.
3	522	L	1961	293-363			99.0	1.0	Similar to the above specimen.
4	522	L	1961	293-363			98.5	1.5	Similar to the above specimen.
5	898	L	1961	291-317	3-5	B-5	99.0	1.0	Amorphous specimen prepared from the melt of 99.9999 pure selenium by rapid cooling in vacuum.

DATA TABLE NO. 183 THERMAL CONDUCTIVITY OF (SELENIUM + THALLIUM) ALLOYS

(Se + Tl > 99.50%; impurity < 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
293.2	0.0197
303.2	0.0182
313.2	0.0163
323.2	0.0151
333.2	0.0142
343.2	0.0126
353.2	0.0117
363.2	0.0100

CURVE 2

T	k
293.2	0.0205
303.2	0.0192
313.2	0.0176
323.2	0.0163
333.2	0.0151
343.2	0.0130
353.2	0.0121
363.2	0.0109

CURVE 3

T	k
293.2	0.0238
303.2	0.0230
313.2	0.0213
323.2	0.0197
333.2	0.0192
343.2	0.0180
353.2	0.0169
363.2	0.0159

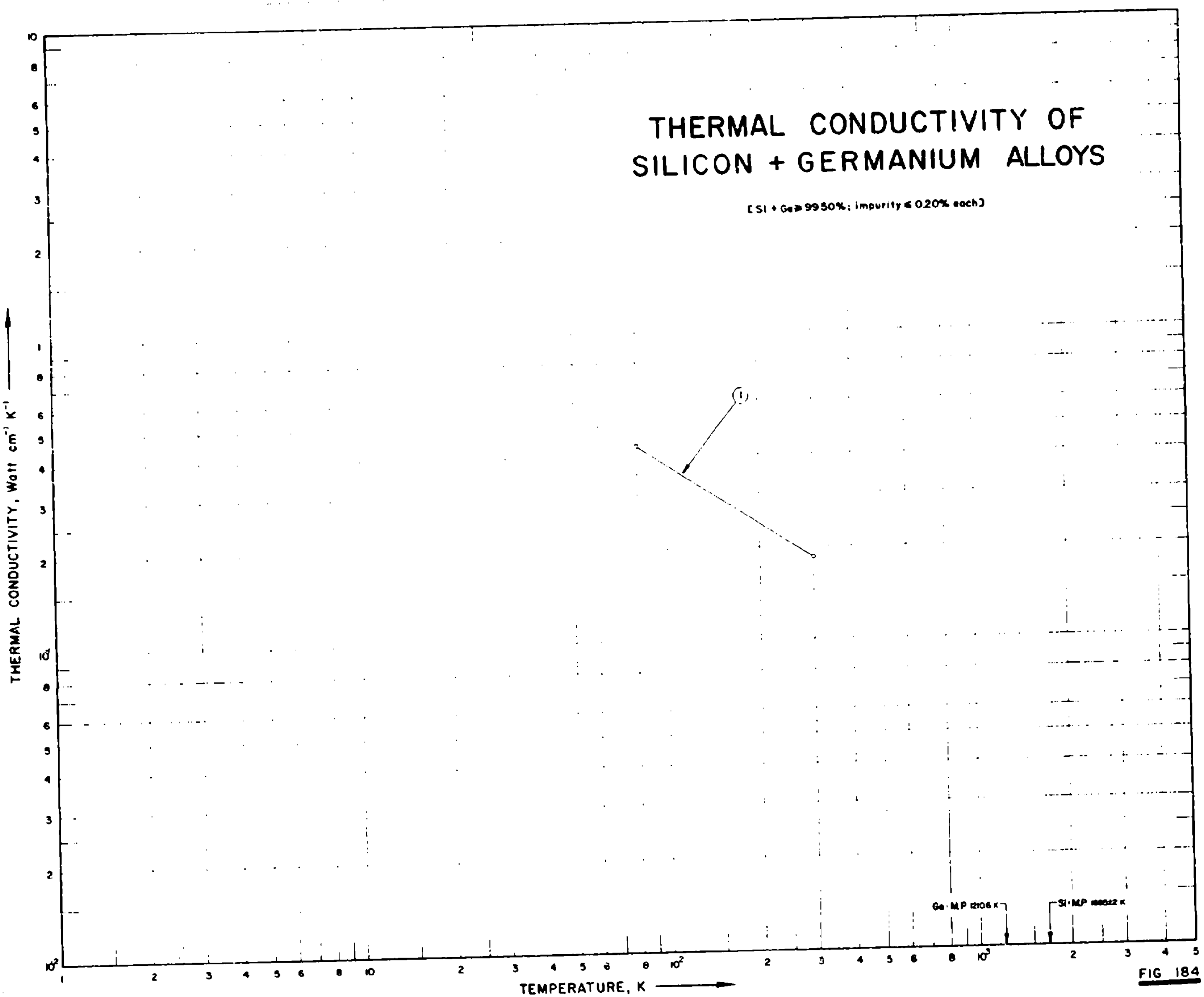
CURVE 4

T	k
293.2	0.0259
303.2	0.0245
313.2	0.0234
323.2	0.0222
333.2	0.0207
343.2	0.0188
353.2	0.0176
363.2	0.0163

CURVE 5

T	k
290.9	0.0113
292.3	0.0113*
294.3	0.0113*
296.9	0.0113*
299.0	0.0115
300.9	0.0116*
302.6	0.0116*
305.3	0.0120
306.8	0.0126
307.1	0.0125*
307.8	0.0128
311.0	0.0126*
313.9	0.0126*
316.9	0.0126

* Not shown on plot



THERMAL CONDUCTIVITY OF SILICON + GERMANIUM ALLOYS
[Si + Ge ≥ 99.50%; impurity ≤ 0.20% each]
Ge: M.P. 1210.6 K
Si: M.P.
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 184

SPECIFICATION TABLE NO. 184 THERMAL CONDUCTIVITY OF [SILICON + GERMANIUM] ALLOYS

(Si + Ge > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 184]

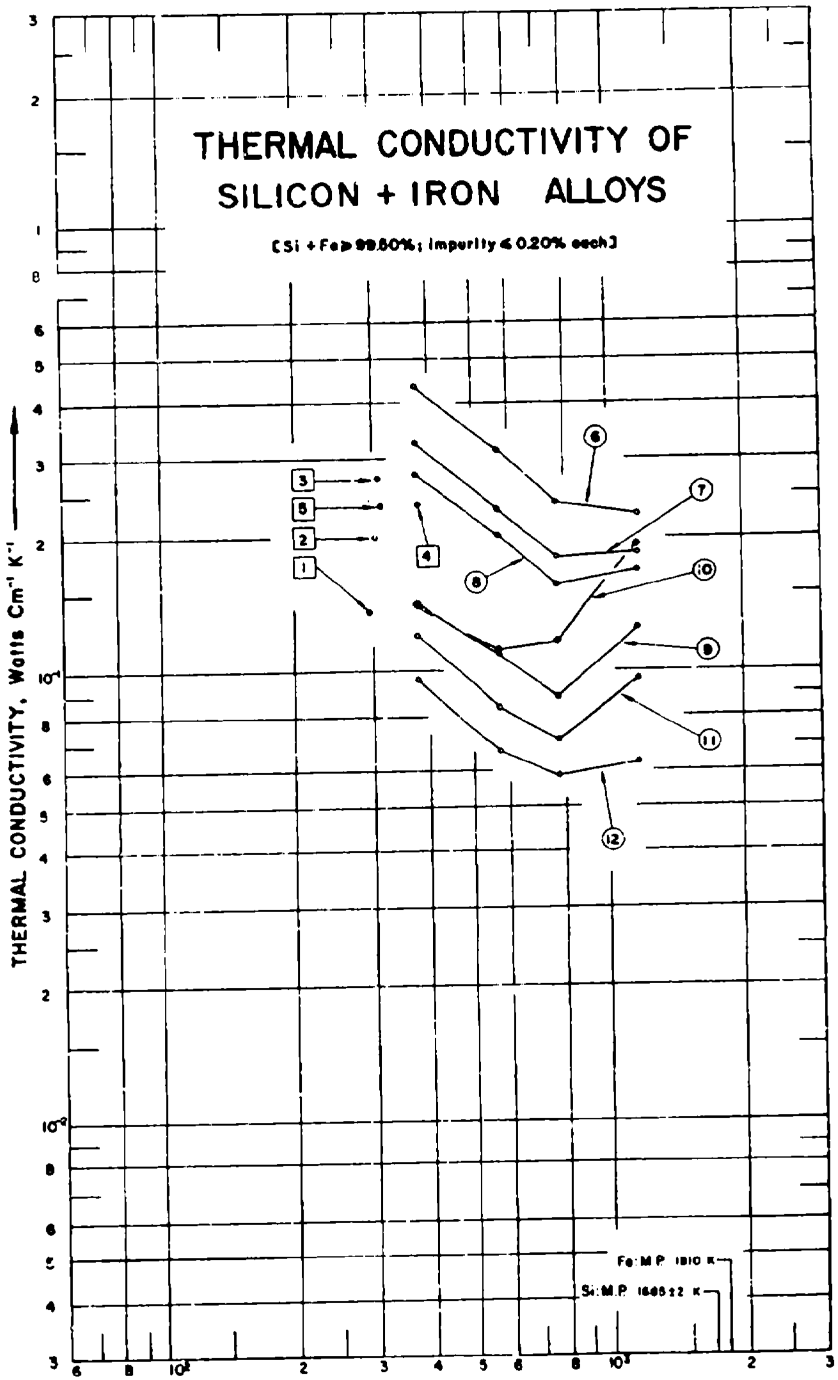
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Si	Ge	Composition (continued), Specifications and Remarks
1	263	L	1958	80, 300			77.69	22.31	n-type; calculated composition; Sb-doped; lattice constant 5.448; specimen 5 x 5 x 15 mm; grown by zone leveling technique; grain size < 1 cm dia; measured in vacuo of ~10^{-6} mm Hg; electrical resistivity 18 ohm cm at 300 K.

DATA TABLE NO. 184 THERMAL CONDUCTIVITY OF [SILICON + GERMANIUM] ALLOYS

(Si + Ge ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
80	0.431
300	0.185



THERMAL CONDUCTIVITY OF
SILICON + IRON ALLOYS
[Si + Fe ≥ 99.80%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Fe: M.P. 1810 K
Si: M.P. 1685±2 K

FIG 185

SPECIFICATION TABLE NO. 185 THERMAL CONDUCTIVITY OF [SILICON + IRON] ALLOYS

(Si + Fe ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 185]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Si	Fe	Composition (continued), Specifications and Remarks
1	204	L	1937	295.5		Russian ferrosilicon; 1	76.8	23.2	Porous specimen; cross-section 20 x 20 mm.
2	204	L	1937	304.7		Russian ferrosilicon; 2	71.7	28.3	Specimen cross section 20 x 20 mm.
3	204	L	1937	309.2		Russian ferrosilicon; 3	73.15	26.85	Specimen cross section 26 x 20 mm; heat flow perpendicular to thickness.
4	204	L	1937	281.1		Russian ferrosilicon; 4	78.8	21.2	Specimen cross section 20 x 20 mm.
5	204	L	1937	315.6		Russian ferrosilicon; 5	76.8	23.2	Specimen cross section 20 x 20 mm.
6	356	R	1956	373-1173	±7		90.0	10.0	No details reported.
7	356	R	1956	373-1173	±7		80.0	20.0	No details reported.
8	356	R	1956	373-1173	±7		75.0	25.0	No details reported.
9	356	R	1956	373-1173	±7		62.0	38.0	No details reported.
10	356	R	1956	373-1173	±7		59.0	41.0	No details reported.
11	356	R	1956	373-1173	±7		55.5	44.5	No details reported.
12	356	R	1956	373-1173	±7		52.5	47.5	No details reported.

DATA TABLE NO. 185 THERMAL CONDUCTIVITY OF (SILICON + IRON) ALLOYS

($Si + Fe \geq 99.50\%$; impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k
CURVE 1	
295.5	0.136
CURVE 2	
304.7	0.200
CURVE 3	
309.2	0.271
CURVE 4	
381.1	0.236
CURVE 5	
315.6	0.236
CURVE 6	
373.2	0.431
573.2	0.314
773.2	0.238
1173.2	0.224
CURVE 7	
373.2	0.326
573.2	0.230
773.2	0.180
1173.2	0.184
CURVE 8	
373.2	0.276
573.2	0.201
773.2	0.155
1173.2	0.167
CURVE 9	
373.2	0.142
573.2	0.109
CURVE 9 (cont.)	
773.2	0.0879
1173.2	0.126
CURVE 10	
373.2	0.142
573.2	0.113
773.2	0.117
1173.2	0.192
CURVE 11	
373.2	0.121
573.2	0.0837
773.2	0.0711
1173.2	0.0962
CURVE 12	
373.2	0.0962
573.2	0.0669
773.2	0.0506
1173.2	0.0C28

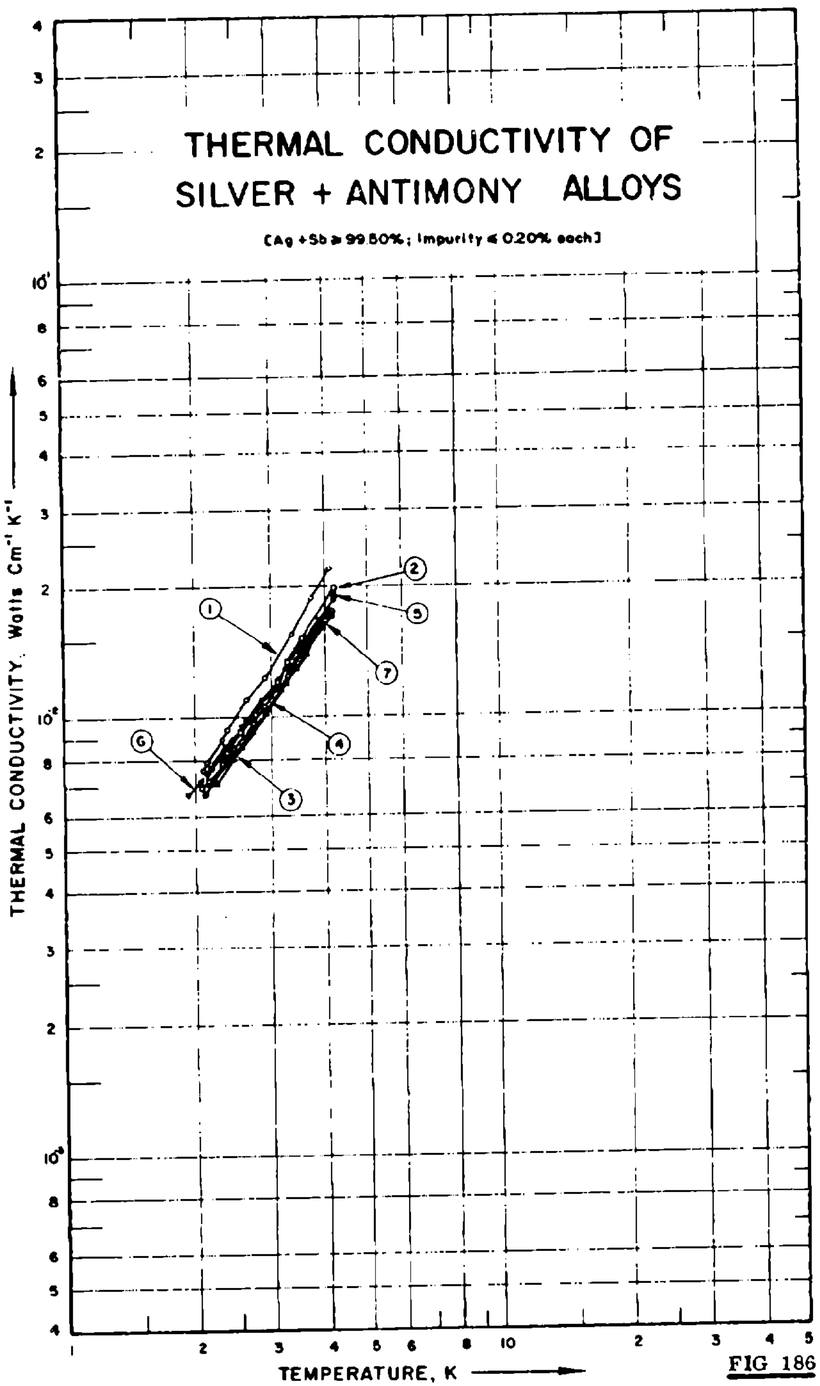

THERMAL CONDUCTIVITY OF
SILVER + ANTIMONY ALLOYS
[Ag + Sb ≥ 99.80%; Impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 186

SPECIFICATION TABLE NO. 186 THERMAL CONDUCTIVITY OF [SILVER + ANTIMONY] ALLOYS

(Ag + Sb ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 186]

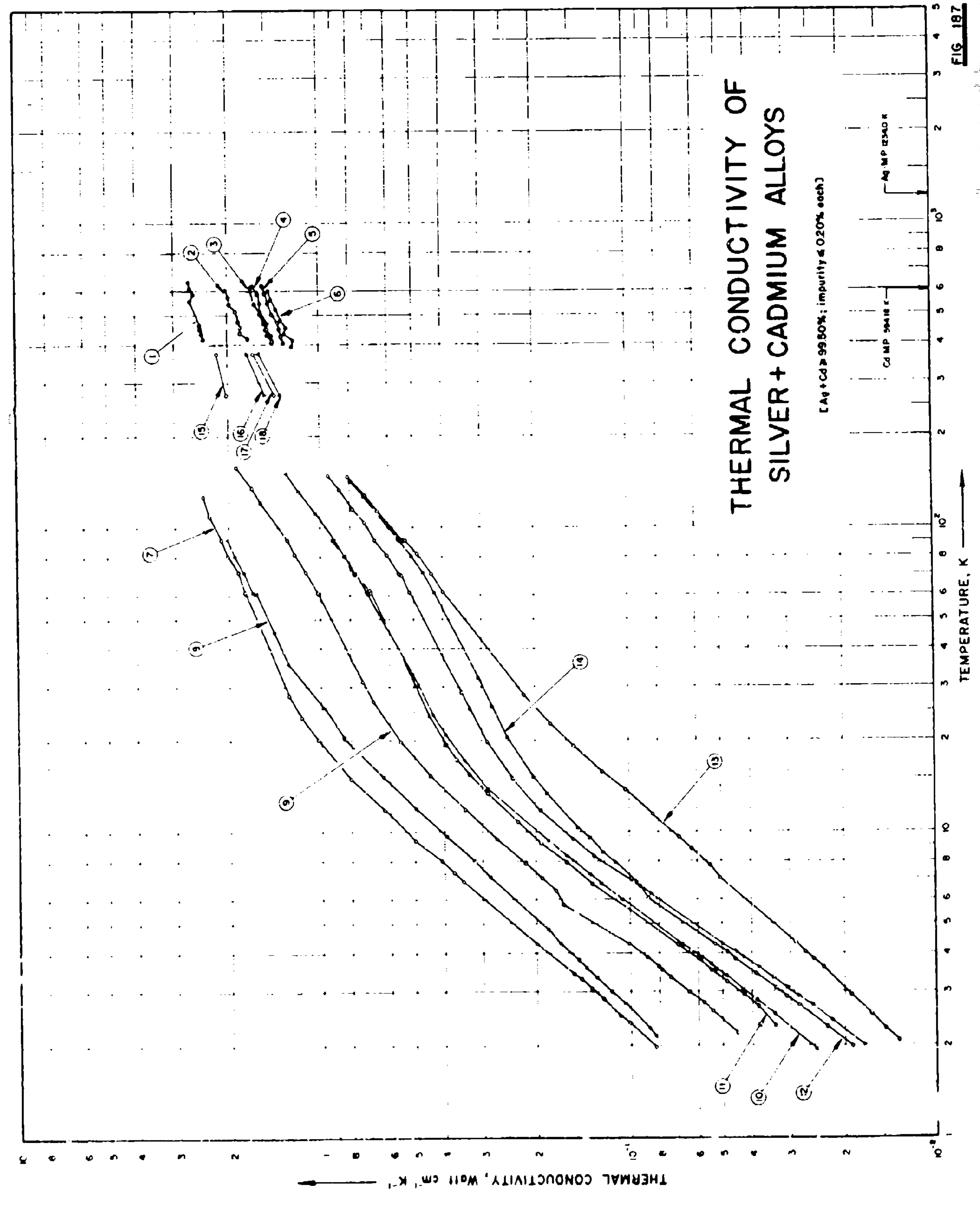
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Sb	Composition (continued), Specifications and Remarks
1	523	L	1959	2.1-4.1		1	97.94	2.06	Impurities < 0.1; cast, machined; specimen 0.100 x 0.150 x 3 in.; annealed for 20 hrs at 50 - 100 C below liquidus; grain size a few tenths of a millimeter; ρ_0 = 12.4 μohm cm.
2	523	L	1959	2.1-4.2		2	96.94	3.06	Similar to the above specimen except ρ_0 = 17.4 μohm cm.
3	523	L	1959	2.2-4.1		3	95.93	4.07	Similar to the above specimen except ρ_0 = 24.7 μohm cm.
4	523	L	1959	2.4-4.1		4	95.53	4.47	Similar to the above specimen except ρ_0 = 28.3 μohm cm.
5	523	L	1959	2.1-4.2		5	94.72	5.28	Similar to the above specimen except ρ_0 = 33.2 μohm cm.
6	523	L	1959	1.9-4.2		6	93.64	6.36	Similar to the above specimen except ρ_0 = 39.5 μohm cm.
7	523	L	1959	2.1-4.1		7			Prepared by melting cutting chips from specimen 4 and 6 (above); ρ_0 = 30.6 μohm cm.

DATA TABLE NO. 186 THERMAL CONDUCTIVITY OF [SILVER + ANTIMONY] ALLOYS

(Ag + Sb ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts cm^{-1} K^{-1}]

T	k
CURVE 1	
2.08	0.00754
2.13	0.00790
2.30	0.00890
2.37	0.00936
2.63	0.0110
2.90	0.0124
3.35	0.0154
3.72	0.0189
4.10	0.0215
CURVE 2	
2.07	0.00690
2.15	0.00718
2.31	0.00784
2.37	0.00832
2.55	0.00924
2.75	0.0101
3.10	0.0121
3.27	0.0134
3.55	0.0151
4.20	0.0198
CURVE 3	
2.23	0.00704
2.41	0.00800
2.55	0.00857
2.70	0.00929
2.90	0.0102
3.15	0.0116
3.42	0.0130
3.62	0.0139
3.82	0.0155
4.10	0.0173
CURVE 4	
2.38	0.00816
2.45	0.00848
2.71	0.00967
2.89	0.0106
3.27	0.0125
CURVE 4(cont.)	
3.50	0.0139
3.70	0.0149
3.92	0.0162
4.13	0.0175
CURVE 5	
2.13	0.00744
2.17	0.00765
2.29	0.00814
2.41	0.00886
2.63	0.00982
3.00	0.0115
3.32	0.0132
3.68	0.0151
3.88	0.0161
4.05	0.0174
4.20	0.0182
CURVE 6	
1.93	0.00665
2.05	0.00711
2.35	0.00851
2.46	0.00897
2.57	0.00950
2.85	0.0109
3.13	0.0123
3.45	0.0142
3.88	0.0167
4.20	0.0186
CURVE 7	
2.10	0.00666
2.17	0.00702
2.39	0.00801
2.68	0.00920
3.23	0.0120
3.62	0.0141
4.13	0.0171


THERMAL CONDUCTIVITY OF
SILVER + CADMIUM ALLOYS
[Ag + Cd ≥ 99.50%; impurity ≤ 0.20% each]
FIG 187
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹

SPECIFICATION TABLE NO. 187 THERMAL CONDUCTIVITY OF (SILVER + CADMIUM) ALLOYS

(Ag + Cd ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 187]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Composition (weight percent) Cd	Composition (continued), Specifications and Remarks
1	[illegible]	C	1951	[illegible]-646		5A	94.65	5.35	Cast and machined; cylindrical specimen slight porosity on axis; Armco iron used as standard.
2	[illegible]	C	1951	420-608		12B	87.1	12.9	Similar to the above with 25 internal voids 1/8 to 1/32 in. in dia.
3	[illegible]	C	1951	412-648		20A	77.8	22.0	Cast, cold-rolled (67% reduction), machined; Armco iron used as standard.
4	[illegible]	C	1951	408-[illegible]		25A	75.2	24.5	Similar to the above specimen.
5	[illegible]	C	1951	405-62[illegible]		30A	68.1	31.8	Similar to the above specimen.
6	[illegible]	C	1951	395-604		38A	64.35	35.65	Cast and machined; cylindrical specimen; small voids visible throughout; Armco iron used as standard.
7	240	L	1956	2.0-127			98.04	1.96	Supplied by Johnson, Matthey and Co., Ltd.; annealed at 530 C; ρ_0 = 0.62 μohm cm; electrical resistivity at 293 K; $\rho(293)$ = 2.26 μohm cm.
8	240	L	1956	2.1-91			98.04	1.96	The above specimen before annealing.
9	240	L	1956	2.2-159			95.09	4.91	Supplied by Johnson, Matthey and Co., Ltd.; annealed at 530 C; ρ_0 = 1.38 μohm cm; $\rho(293)$ = 3.13 μohm cm.
10	240	L	1956	1.9-1[illegible]			90.49	9.51	Supplied by Johnson, Matthey and Co., Ltd.; annealed at 500 C.
11	240	L	1956	2.3-91			90.49	9.51	Supplied by Johnson, Matthey and Co., Ltd.; annealed at 610 C. ρ_0 = 2.26 μohm cm, $\rho(293)$ = 4.09 μohm cm.
12	240	L	1956	2.0-149			80.79	19.21	Supplied by Johnson, Matthey and Co., Ltd.; annealed at 500 C; ρ_0 = 3.30 μohm cm; $\rho(293)$ = 5.82 μohm cm.
13	240	L	1956	2.0-148			80.79	19.21	The above specimen before annealing.
14	240	L	1956	2.0-145			70.03	29.97	Supplied by Johnson, Matthey and Co., Ltd.; annealed at 500 C; ρ_0 = 3.67 μohm cm, $\rho(293)$ = 6.22 μohm cm.
15	246	T	1919	273, 373			95.84	4.16	Calculated composition; wire, 1 mm dia; rolled and drawn; annealed for 1/2 hr close to melting point; electrical conductivity, 29.3 and 24.2 x 10^4 ohm^{-1}cm^{-1} at 0 and 100 C, respectively.
16	246	T	1919	273, 373			90.86	9.14	Similar to the above specimen except electrical conductivity 21.0 and 19.2 x 10^4 ohm^{-1} cm^{-1} at 0 and 100 C, respectively.
17	246	T	1919	273, 373			87.66	12.34	Similar to the above specimen except electrical conductivity 19.2 and 18.0 x 10^4 ohm^{-1} cm^{-1} at 0 and 100 C, respectively.
18	246	T	1919	273, 373			83.13	16.87	Similar to the above specimen except electrical conductivity 17.1 and 14.9 x 10^4 ohm^{-1} cm^{-1} at 0 and 100 C, respectively.

DATA TABLE NO. 187 THERMAL CONDUCTIVITY OF [SILVER + CADMIUM] ALLOYS

(Ag + Cd 99.50%, impurity 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
419.1	2.406
435.5	2.448
450.6	2.464
465.3	2.473
559.4	2.661
588.5	2.598
617.6	2.657
645.5	2.686

CURVE 2

T	k
420.4	1.715
439.2	1.812
458.7	1.816
477.9	1.849
511.6	1.887
543.9	1.975
570.7	1.983
607.5	2.038

CURVE 3

T	k
412.2	1.431
431.4	1.485
451.8	1.481
473.2	1.527
506.2	1.573
544.6	1.640
617.9	1.686

CURVE 4

T	k
367.8	1.427
[illegible]	1.413
[illegible]	1.450
[illegible]	1.481
[illegible]	1.505
[illegible]	1.573
[illegible]	1.594
[illegible]	[illegible]

CURVE 5

T	k
405.2	1.310
428.9	1.343
451.2	1.351
473.8	1.372
505.0	1.431
549.3	1.477
590.8	1.506
627.2	1.548

CURVE 6

T	k
395.2	1.230
416.2	1.218
438.6	1.301
458.7	1.289
482.2	1.343
525.4	1.381
565.0	1.443
603.7	1.464

CURVE 7

T	k
1.974	0.0824
2.360	0.1005
2.489	0.1072
2.839	0.1221
3.060	0.1331
3.286	0.144
3.434	0.1522
4.303	0.1986
6.89	0.3465
7.78	0.3717
8.02	0.4074
9.37	0.459
11.76	0.6244
14.98	0.801
20.1	1.029
23.8	1.159
28.1	1.271
61.7	1.767
71.7	1.863
81.2	2.008

CURVE 7 (cont.)

T	k
91.4	2.112
109.8	2.312
127.4	2.428

CURVE 8

T	k
2.148	0.0823
2.257	0.0866
2.723	0.1044
2.994	0.1149
3.308	0.1265
3.561	0.1371
3.793	0.1461
4.294	0.1665
4.782	0.183
7.09	0.282
8.04	0.320
9.64	0.392
11.90	0.495
15.09	0.629
20.54	0.848
25.54	0.976
35.73	1.284
45.20	1.425
60.97	1.636
61.13	1.679
71.52	1.787
80.51	1.906
91.28	2.020

CURVE 9

T	k
2.199	0.0447
2.592	0.0539
2.757	0.0578
2.986	0.0642
3.344	0.0737
3.536	0.0788
3.669	0.0809
3.871	0.0880
4.287	0.1004
5.78	0.163

CURVE 9 (cont.)

T	k
6.41	0.1725
7.06	0.191
7.88	0.216
9.46	0.269
11.76	0.341
15.36	0.445
19.80	0.556
26.8	0.677
31.2	0.730
61.2	1.024
71.6	1.121
81.9	1.207
91.5	1.280
121.9	1.569
136.3	1.677
158.8	1.893

CURVE 10

T	k
1.939	0.0247
2.516	0.0337
2.797	0.0385
3.044	0.0428
3.359	0.0485
3.538	0.0522
3.666	0.0545
3.864	0.0585
4.284	0.0673
6.00	0.106
6.75	0.123
7.26	0.134
8.31	0.159
9.31	0.182
13.83	0.287
17.26	0.343
20.83	0.394
24.15	0.433
30.23	0.483
61.69	0.709
70.73	0.769
80.16	0.831
91.24	0.902

CURVE 10 (cont.)

T	k
111.57	1.041
132.40	1.173
151.22	1.299

CURVE 11

T	k
2.314	0.0336
2.682	0.0381
2.928	0.0426
3.232	0.0482
3.517	0.0541
3.839	0.0598
4.284	0.0697
6.74	0.1312
7.93	0.1590
9.18	0.1922
10.68	0.229
13.39	0.289
15.50	0.330
17.25	0.364
19.43	0.393
24.06	0.445
61.08	0.687
62.28	0.690
70.72	0.766
80.39	0.834
91.05	0.908

CURVE 12

T	k
1.991	0.0188
2.297	0.0227
2.695	0.0280
2.887	0.0307
3.071	0.0335
3.416	0.0387
3.843	0.0451
4.025	0.0480
4.282	0.0528
6.05	0.0871
6.65	0.0925
8.31	0.1302

CURVE 12 (cont.)

T	k
9.44	0.151
11.79	0.192
14.95	0.237
19.67	0.289
25.38	0.329
28.81	0.349
61.30	0.517
69.78	0.546
70.54	0.559
81.06	0.609
91.03	0.666
104.5	0.717
116.2	0.782
133.9	0.866
148.8	0.941

CURVE 13

T	k
2.075	0.0133
2.261	0.0147
2.526	0.0164
3.310	0.0150
3.586	0.0235
3.828	0.0252
4.023	0.0267
4.319	0.0286
7.03	0.0504
7.73	0.0545
8.78	0.0624
9.60	0.0686
11.46	0.0839
13.72	0.1025
15.86	0.121
19.11	0.150
22.55	0.177
28.14	0.216
61.51	0.399
70.68	0.436
82.04	0.487
91.18	0.542
91.0	0.540
91.02	0.532

CURVE 13 (cont.)

T	k
91.22	0.545
113.95	0.652
128.3	0.713
147.7	0.812

CURVE 14

T	k
2.002	0.01726
2.405	0.0229
2.709	0.02566
2.889	0.02807
3.087	0.03081
3.310	0.03404
3.579	0.0378
3.867	0.0424
4.016	0.0450
4.29	0.0498
6.24	0.0853
6.84	0.0951
7.92	0.111
8.57	0.121
9.51	0.134
10.32	0.1455
13.36	0.184
15.12	0.203
20.50	0.247
25.8	0.276
32.1	0.307
61.2	0.428
71.4	0.467
80.9	0.509
91.2	0.555
91.2	0.559
127.6	0.717
145.3	0.796

CURVE 15

T	k
273.2	2.03
373.2	2.19

CURVE 16

T	k
273.2	1.52
373.2	1.74

CURVE 17

T	k
273.2	1.41
373.2	1.66

CURVE 18

T	k
273.2	1.36
373.2	1.59

SPECIFICATION TABLE NO. 188 THERMAL CONDUCTIVITY OF (SILVER + COPPER) ALLOYS

(Ag + Cu ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Cu	Composition (continued), Specifications and Remarks
1	230	L	1925	335.2			95.0	5.0	Impurities 0.03.
2	230	L	1925	335.2			85.0	15.0	Impurities 0.03.
3	230	L	1925	335.2			75.0	25.0	Impurities 0.03.
4	230	L	1925	335.2			65.0	35.0	Impurities 0.03.
5	230	L	1925	335.2			60.0	40.0	Impurities 0.03.
6	230	L	1925	335.2			55.0	45.0	Impurities 0.03.
7	230	L	1925	335.2			53.0	47.0	Impurities 0.03.
8	230	L	1925	335.2			50.0	50.0	Impurities 0.03.

DATA TABLE NO. 188 THERMAL CONDUCTIVITY OF (SILVER + COPPER) ALLOYS

(Ag + Cu ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k	T	k	T	k
CURVE 1*		CURVE 4*		CURVE 7*	
335.2	3.519	335.2	3.192	335.2	3.109
CURVE 2*		CURVE 5*		CURVE 8*	
335.2	3.431	335.2	3.113	335.2	3.126
CURVE 3*		CURVE 6*			
335.2	3.301	335.2	3.134		

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* No graphical presentation

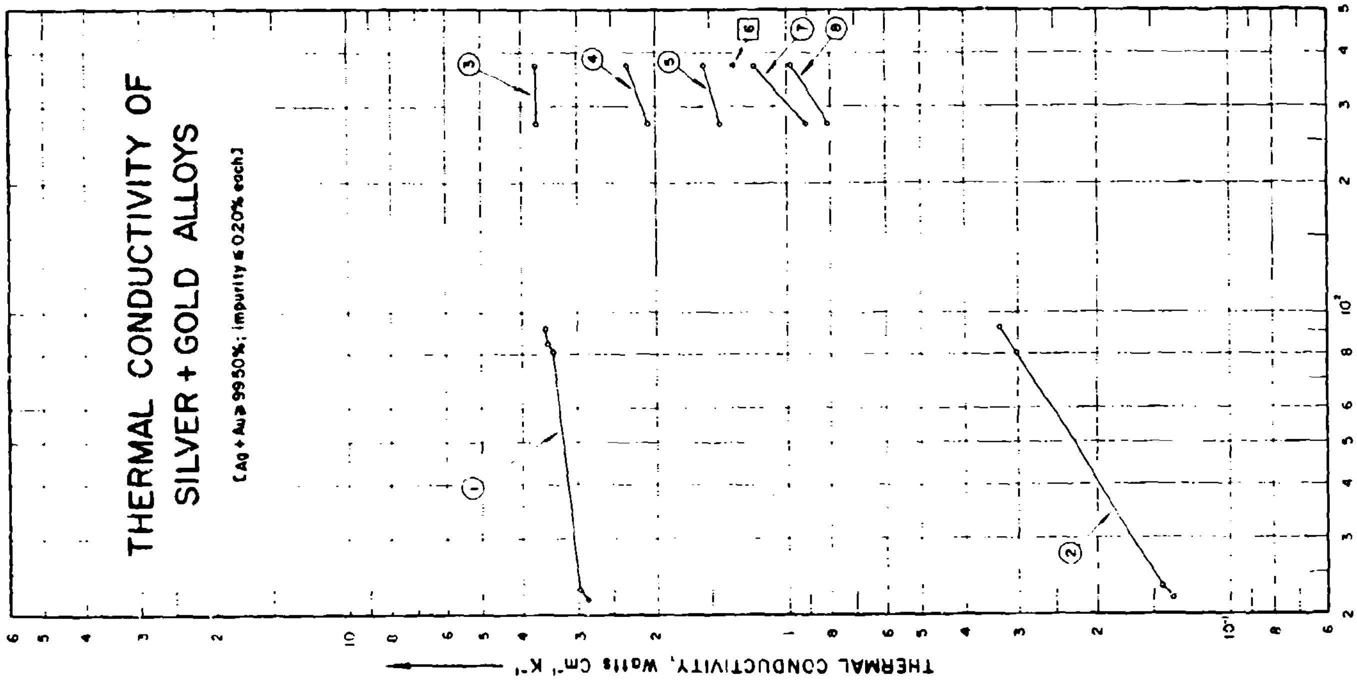

THERMAL CONDUCTIVITY OF
SILVER + GOLD ALLOYS
[Ag + Au ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
4
5
6
7
8

FIG 189

SPECIFICATION TABLE NO. 189 THERMAL CONDUCTIVITY OF [SILVER + GOLD] ALLOYS

(Ag + Au ≥ 99.50%, ≤ 0.20% each)

[For Data Reported in Figure and Table No. 189]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Au	Composition (continued), Specifications and Remarks
1	58	L	1934	22-92			99.3	0.7	Calculated composition, wire specimen; electrical resistivity 0.163, 0.473, and 1.63 μohm cm at 0, -190, and -251 C, respectively.
2	58	L	1934	22-92			62.2	37.8	Calculated composition; single crystal; wire specimen; electrical resistivity 6.87, 7.25, and 8.57 μohm cm at 0, -190, and -251 C, respectively.
3	246	T	1919	273,373			95.88	4.12	Calculated composition; wire, 1 mm dia.; rolled and drawn; annealed close to melting point for 0.5 hr.
4	246	T	1919	273,373			91.22	8.78	Similar to the above specimen, electrical conductivity 29.3 and 24.2 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.
5	246	T	1919	273,373			80.74	19.26	Similar to the above specimen except electrical conductivity 19.5 and 16.0 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.
6	246	T	1919	373.2			76.34	23.66	Similar to the above specimen except electrical conductivity 14.7 and 13.5 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.
7	246	T	1919	273,373			68.63	31.37	Similar to the above specimen except electrical conductivity 12.5 to 11.5 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.
8	246	T	1919	273,373			55.84	44.16	Similar to the above specimen except electrical conductivity 10.3 and 9.7 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.

DATA TABLE NO. 189 THERMAL CONDUCTIVITY OF SILVER + GOLD ALLOYS

(Ag + Au ≥ 99.50%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
21.7	2.87
22.8	3.01
80.7	3.45
84.3	3.53
91.7	3.56
CURVE 2	
21.8	0.136
23.2	0.144
80.2	0.304
80.2	0.302
92.0	0.334
CURVE 3	
273.2	3.71
373.2	3.72
CURVE 4	
273.2	2.08
373.2	2.30
CURVE 5	
273.2	1.42
373.2	1.55
CURVE 6	
373.2	1.32
CURVE 7	
273.2	0.91
373.2	1.19
CURVE 8	
273.2	0.81
373.2	0.98

FIGURE SHOWS ONLY 7 OF THE CURVES REPORTED IN TABLE

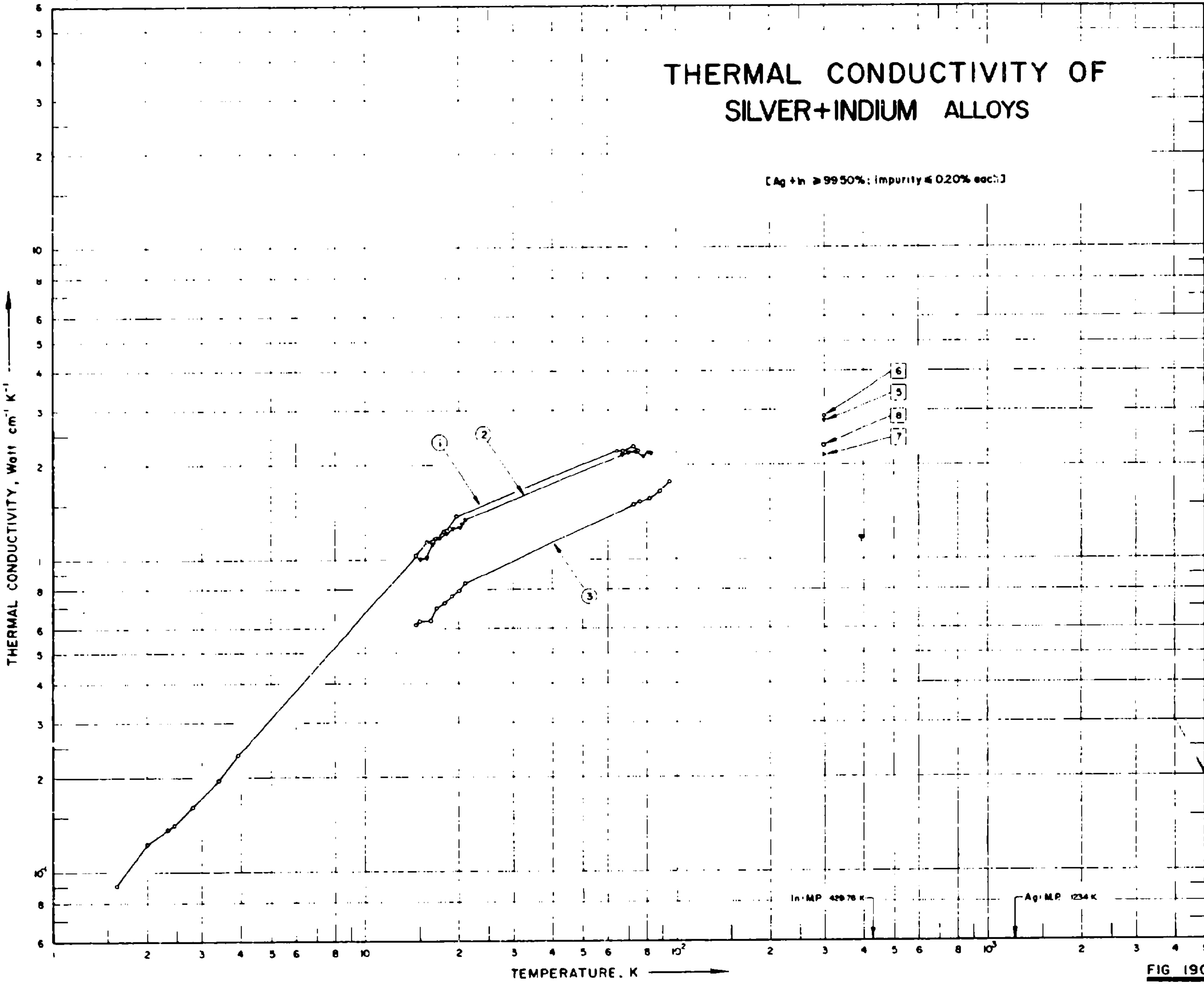


FIG 190

SPECIFICATION TABLE NO. 190 THERMAL CONDUCTIVITY OF SILVER + INDIUM ALLOYS

(Ag + In ≥ 99.50%, impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 190]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	In	Composition (continued), Specifications and Remarks
1	22	L	1959	1.6-76			99.75	0.25	Calculated composition; polycrystalline specimen ~6 cm long; ρ_0 = 0.45 μohm cm (same as the succeeding specimen, Ag - In 1)
2	51	L	1956	15-87		Ag - In 1	99.75	0.25	Calculated composition, prepared from Ag (pure, supplied by Nordiska Affiveriet) and In (< 0.00005 impurity); annealed in vacuo at 720 C; electrical resistivity ranging from 0.425 to 1.89 μohm cm at 14 to 273 K, respectively.
3	51	L	1956	15-95		Ag - In 2	99.45	0.55	Similar to the above specimen except electrical resistivity ranging from 0.895 to 2.395 μohm cm at 14 to 273 K, respectively.
4	904	C	1962	298.2			99.0	1.0	Cast; copper used as comparative material.
5	904	C	1962	298.2			98.0	2.0	Cast; copper used as comparative material.
6	904	C	1962	298.2			97.0	3.0	Cast; copper used as comparative material.
7	904	C	1962	298.2			96.0	4.0	Cast; copper used as comparative material.
8	904	C	1962	298.2			95.0	5.0	Cast; copper used as comparative material.

DATA TABLE NO. 190 THERMAL CONDUCTIVITY OF [SILVER + INDIUM] ALLOYS

($Ag + In \geq 99.50\%$; *impurity* $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		**CURVE 3 (cont.)**	
1.59	0.091	18.0	0.722
2.00	0.123	19.0	0.760
2.33	0.137	20.0	0.796
2.45	0.142	21.0	0.844
2.80	0.162	73.0	1.509
3.40	0.196	76.8	1.530
3.93	0.236	82.0	1.570
14.69	1.035	88.2	1.650
15.89	1.114	94.8	1.770
16.87	1.158		
17.99	1.228	**CURVE 4***	
18.33	1.237		
19.73	1.385	298.2	2.74
19.88	1.395		
64.46	2.242	**CURVE 5**	
67.27	2.232		
72.72	2.304	298.2	2.75
75.47	2.236		
		CURVE 6	
CURVE 2			
		298.2	2.85
15.0	1.00		
15.7	1.01	**CURVE 7**	
16.5	1.12		
17.4	1.17	298.2	2.15
18.3	1.22		
19.1	1.25	**CURVE 8**	
20.2	1.26		
20.5	1.30	298.2	2.31
20.9	1.35		
67.0	2.17		
70.9	2.20		
74.4	2.20		
78.0	2.12		
81.2	2.20		
83.2	2.19		
CURVE 3			
14.7	0.618		
15.0	0.632		
16.3	0.632		
17.0	0.696		

* Not shown on plot

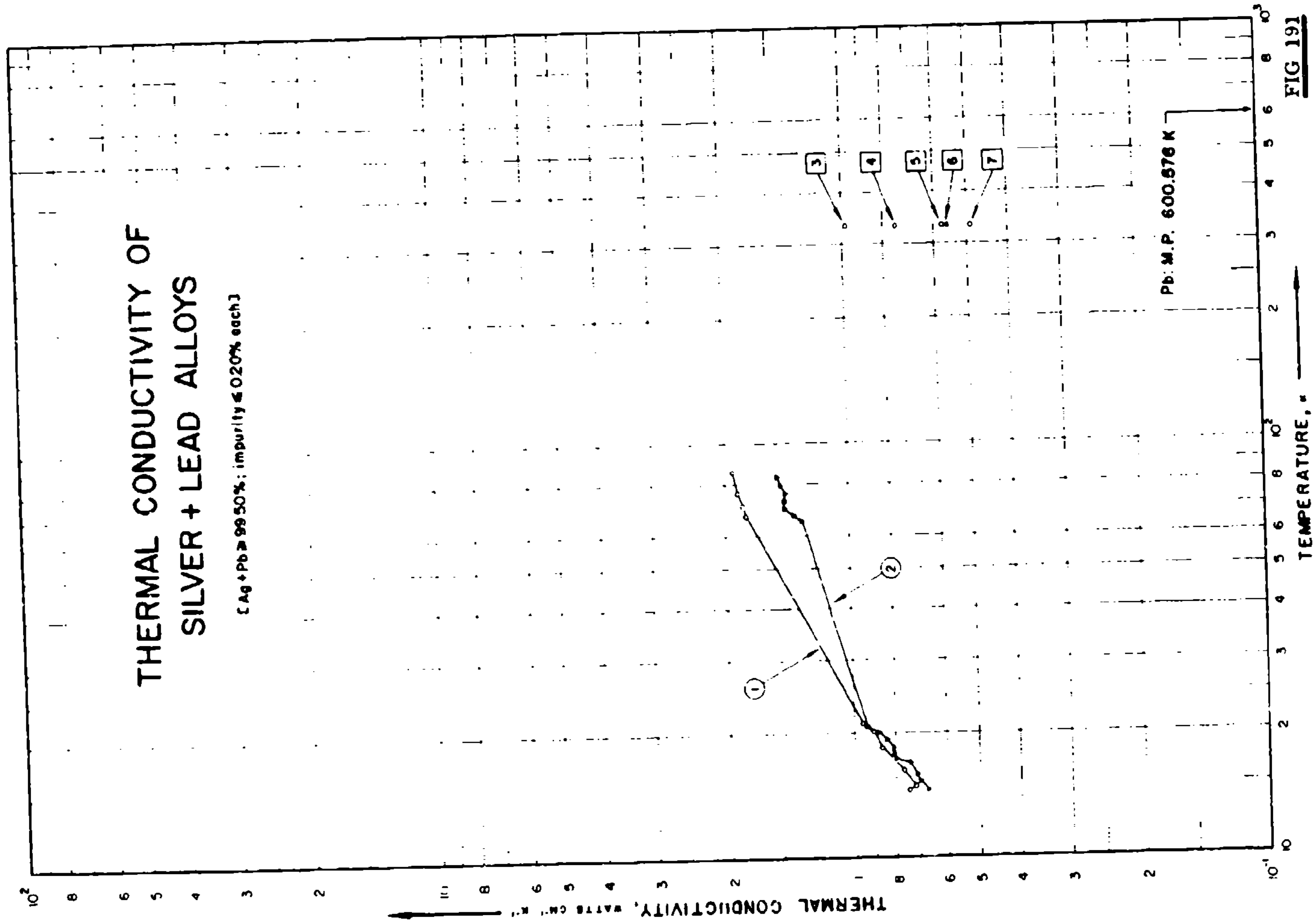

THERMAL CONDUCTIVITY OF
SILVER + LEAD ALLOYS
[Ag+Pb ≥ 99.50%; impurity ≤ 0.20% each]
Pb: M.P. 600.576 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, watts cm⁻¹ K⁻¹

FIG 191

SPECIFICATION TABLE NO. 191 THERMAL CONDUCTIVITY OF SILVER + LEAD ALLOYS

(Ag + Pb ≥ 99.50%, impurity ≤ 0.20% each)

For Data Reported in Figure and Table No. 191

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Pb	Composition (continued), Specifications and Remarks
1	51	L	1956	15-86		Ag-Pb 1	99.75	0.25	Calculated composition, prepared from Ag (pure, supplied by Nordiska Affverict) and Pb (< 0.00005 impurity); annealed in vacuo at 720 C; electrical resistivity ranging from 0.637 to 2.07 μohm cm at 14 to 273 K, respectively.
2	51	L	1956	15-83		Ag-Pb 2	99.62	0.38	Similar to the above specimen but quenched in water; electrical resistivity 0.983 to 2.47 μohm cm at 14 to 273 K, respectively.
3	230	L	1925	333			90	10	Prepared by fusing Ag (99.9 pure) and Pb (< 0.03 impurities, supplied by Baker); specimen ~5.5 cm long, 0.3 cm^2 cross-sectional area, electrical conductivity 12.17 x 10^4 ohm^{-1} cm^{-1} at 25 C.
4	230	L	1925	333			80	20	Similar to the above specimen except electrical conductivity 9.43 x 10^4 ohm^{-1} cm^{-1} at 25 C.
5	230	L	1925	333			70	30	Similar to the above specimen except electrical conductivity 7.14 x 10^4 ohm^{-1} cm^{-1} at 25 C.
6	230	L	1925	333			60	40	Similar to the above specimen except electrical conductivity 6.90 x 10^4 ohm^{-1} cm^{-1} at 25 C.
7	230	L	1925	333			50	50	Similar to the above specimen except electrical conductivity 6.15 x 10^4 ohm^{-1} cm^{-1} at 25 C.

DATA TABLE NO. 191 THERMAL CONDUCTIVITY OF [SILVER + LEAD] ALLOYS

[Ag + Pb > 99.50%, impurity < 0.20% each]

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
14.7	0.740
14.9	0.724
16.3	0.763
18.5	0.854
20.3	0.900
21.2	0.956
67.6	1.790
71.0	1.820
76.4	1.860
86.4	1.926
CURVE 2	
14.6	0.668
15.3	0.696
15.6	0.704
15.9	0.710
16.9	0.732
17.4	0.798
18.0	0.805
18.5	0.810
19.3	0.840
20.1	0.876
20.7	0.932
65.2	1.320
67.6	1.370
69.7	1.430
72.8	1.440
76.0	1.430
79.5	1.470
81.0	1.490
83.20	1.490
CURVE 3	
333	0.987
CURVE 4	
333	0.745

T	k
CURVE 5	
333	0.577
CURVE 6	
333	0.561
CURVE 7	
333	0.490

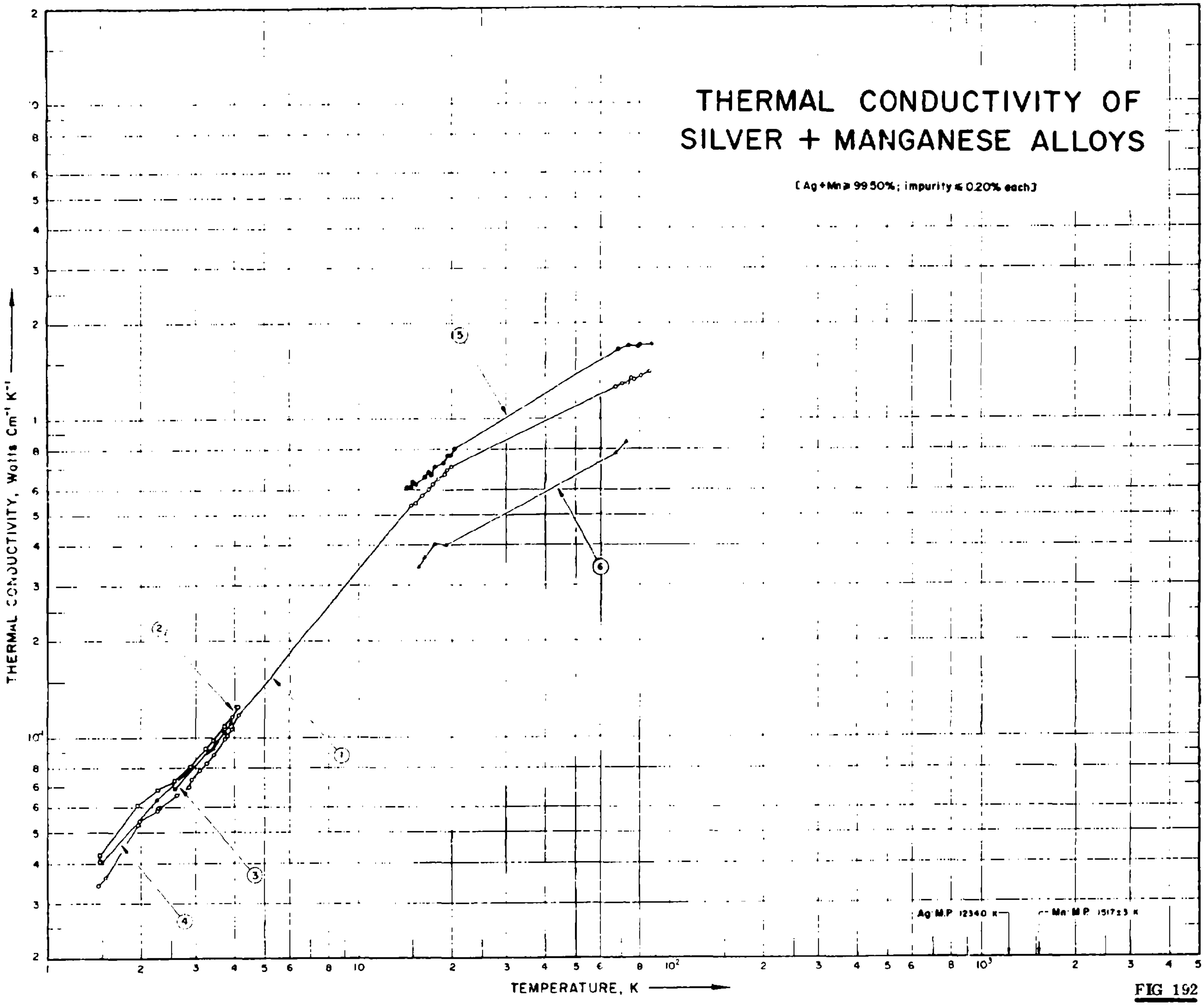

THERMAL CONDUCTIVITY OF
SILVER + MANGANESE ALLOYS
[Ag+Mn ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Ag M.P. 1234.0 K
Mn M.P. 1517±3 K
1
2
3
4
5
6

FIG 192

SPECIFICATION TABLE NO. 192 THERMAL CONDUCTIVITY OF (SILVER + MANGANESE) ALLOYS

(Ag + Mn ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 192]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Mn	Composition (continued), Specifications and Remarks
1	22	L	1959	1.5-87			99.72	0.28	Calculated composition; prepared from pure Ag and Mn with < 0.00005 impurities; uniform polycrystalline; specimen cross-section 2.5 mm²; rolled; ρ_0 = 1.17 μohm cm.
2	649	L	1956	1.5-4.1			99.72	0.28	Calculated composition; measured in a magnetic field of 25.5 kilooersteds.
3	649	L	1956	2.6, 3.7			99.72	0.28	Calculated composition; measured in a magnetic field of 19 kilooersteds.
4	649	L	1956	1.5-3.9			99.72	0.28	Calculated composition; measured in a magnetic field of 12 kilooersteds.
5	51	L	1956	14-88		1	99.72	0.28	Calculated composition; prepared from pure Ag and Mn with < 0.00005 impurities; polycrystalline; supplied by Nordiska Affiveriet, Halsingborg; specimen 2.5 x 2.5 mm² in cross-section, rolled and cut; annealed at 720 K.
6	51	L	1956	16-72		4	87.31	12.69	Similar to the above specimen.

DATA TABLE NO. 192 THERMAL CONDUCTIVITY OF [SILVER + MANGANESE] ALLOYS

(Ag + Mn > 99.50%; Impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k	T	k	T	k
CURVE 1		**CURVE 2**		**CURVE 5 (cont.)**	
1.47	0.0340	1.48	0.0405	17.7	0.702
1.55	0.0359	1.48	0.0425	18.8	0.724
1.96	0.0528	1.95	0.0610	19.4	0.764
1.98	0.0541	2.27	0.0680	19.8	0.764
2.27	0.0584	2.57	0.0727	20.4	0.800
2.28	0.0597	2.88	0.0805	68.4	1.660
2.31	0.0598	3.23	0.0920	74.0	1.700
2.61	0.0657	3.41	0.0980	79.2	1.690
2.86	0.0637	3.70	0.106	80.6	1.710
2.91	0.0734	3.92	0.115	88.0	1.720
3.08	0.0793	4.10	0.123		
3.26	0.0827			**CURVE 6**	
3.43	0.0880	**CURVE 3**			
3.74	0.0990			15.6	0.340
3.81	0.101	2.58	0.0688	16.4	0.365
3.92	0.106	3.72	0.1038	17.6	0.492
4.12	0.117			19.2	0.398
14.83	0.532	**CURVE 4**		67.6	0.780
15.31	0.544			72.4	0.840
16.05	0.573	1.50	0.0402		
16.98	0.599	2.25	0.0635		
17.48	0.620	3.41	0.0926		
18.03	0.643	3.91	0.111		
18.96	0.668				
19.38	0.689	**CURVE 5**			
19.96	0.704				
67.46	1.260	14.4	0.610		
70.98	1.285	14.8	0.610		
73.98	1.286	15.0	0.632		
75.48	1.348	15.4	0.622		
77.39	1.328	16.3	0.654		
81.58	1.361	16.8	0.678		
86.51	1.406	17.2	0.664		

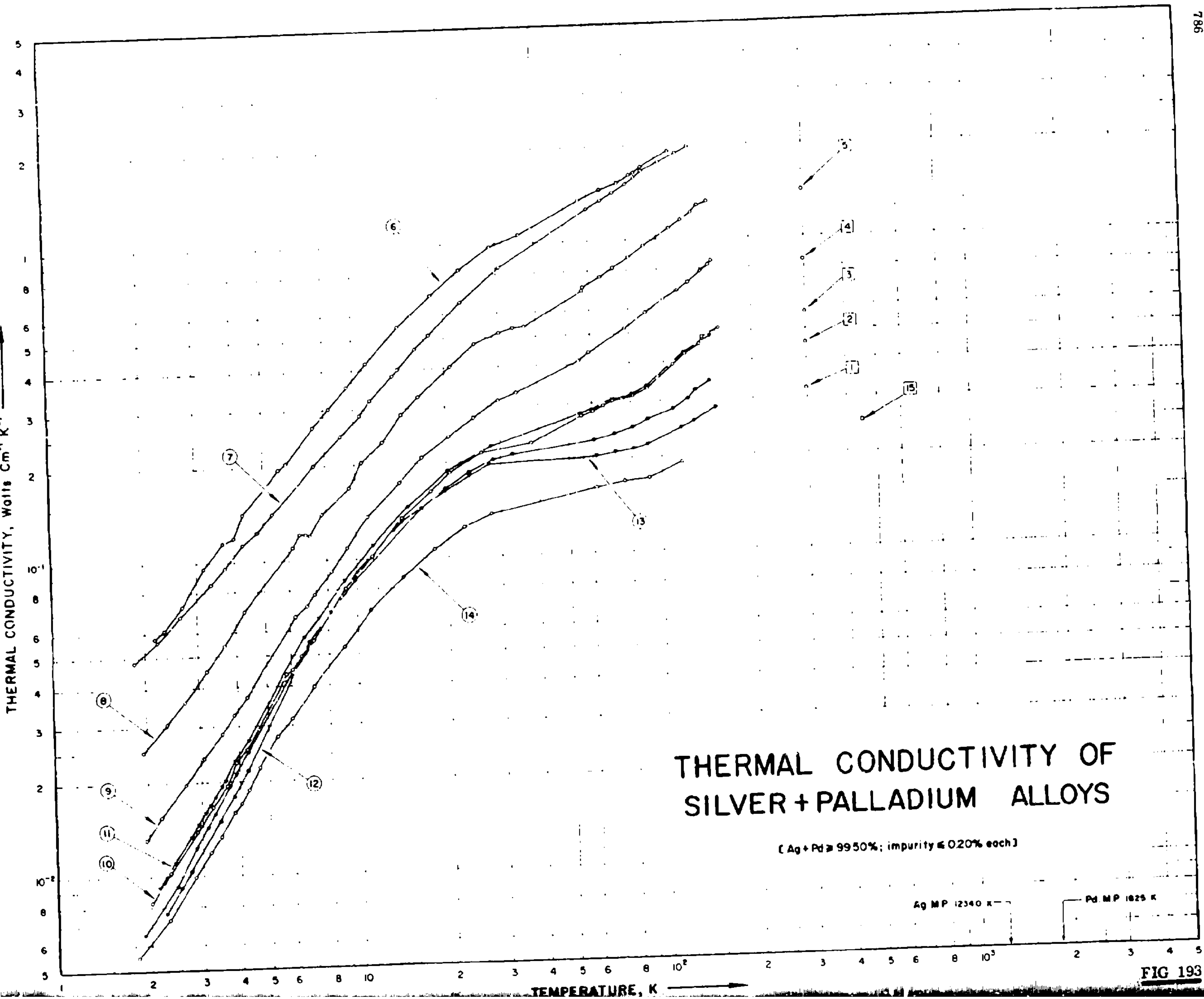

THERMAL CONDUCTIVITY OF
SILVER + PALLADIUM ALLOYS
[Ag + Pd ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Ag M.P. 1234.0 K
Pd M.P. 1825 K
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIG 193

SPECIFICATION TABLE NO. 193 THERMAL CONDUCTIVITY OF [SILVER + PALLADIUM] ALLOYS

(Ag + Pd > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 193]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Pd	Composition (continued), Specifications and Remarks
1	241	E	1911	298.2			50	50	Approx. composition; electrical conductivity 3.03×10^4 ohm^{-1} cm^{-1} at 25 C.
2	241	E	1911	298.2			60	40	Approx. composition; electrical conductivity 4.56×10^4 ohm^{-1} cm^{-1} at 25 C.
3	241	E	1911	298.2			70	30	Approx. composition; electrical conductivity 6.43×10^4 ohm^{-1} cm^{-1} at 25 C.
4	241	E	1911	298.2			80	20	Approx. composition; electrical conductivity 9.47×10^4 ohm^{-1} cm^{-1} at 25 C.
5	241	E	1911	298.2			90	10	Approx. composition; electrical conductivity 16.14×10^4 ohm^{-1} cm^{-1} at 25 C.
6	240	L	1956	2.2-112			97.92	2.08	Specimen supplied by Johnson, Matthey and Co., Ltd.; annealed at 610 C, ρ_0 = 0.89 μohm cm, electrical resistivity 2.52 μohm cm at 293 K.
7	240	L	1956	1.8-123			97.92	2.08	Specimen supplied by Johnson, Matthey and Co., Ltd.; strained; ρ_0 = 0.94 μohm cm, electrical resistivity 2.54 μohm cm at 293 K.
8	240	L	1956	1.9-147			94.94	5.06	Specimen supplied by Johnson, Matthey and Co., Ltd.; annealed at 610 C, ρ_0 = 2.20 μohm cm; electrical resistivity 3.91 μohm cm at 293 K.
9	240	L	1956	2.0-150			90.1	9.9	Specimen supplied by Johnson, Matthey and Co., Ltd.; annealed at 650 C, ρ_0 = 4.15 μohm cm; electrical resistivity 6.0 μohm cm at 293 K.
10	240	L	1956	2.3-157			79.92	20.08	Specimen supplied by Johnson, Matthey and Co., Ltd., annealed at 650 C
11	240	L	1956	2.1-147			79.92	20.08	Specimen supplied by Johnson Matthey and Co., Ltd.; annealed at 800 C ρ_0 = 8.45 μohm cm, electrical resistivity 10.0 μohm cm at 293 K.
12	240	L	1956	2.2-145			70.38	29.62	Specimen supplied by Johnson, Matthey and Co., Ltd.; annealed at 890 C; ρ_0 = 12.78 μohm cm, electrical resistivity 14.66 μohm cm at 293 K.
13	240	L	1956	1.9-151			60	40	Specimen supplied by Johnson, Matthey and Co., Ltd.; annealed at 880 C; ρ_0 = 18.10 μohm cm, electrical resistivity 21.1 μhm cm at 293 K.

SPECIFICATION TABLE NO. 193 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Pd	Composition (continued), Specifications and Remarks
14	240	L	1956	1.8-117			50	50	Specimen supplied by Johnson, Matthey and Co., Ltd.; annealed at 880 C; ρ_c = 27.7 μohm cm, electrical resistivity 27.7 μohm cm at 293 K.
15	390	P	1956	448.2			50	50	

DATA TABLE NO. 193 THERMAL CONDUCTIVITY OF [SILVER + PALLADIUM] ALLOYS

(Ag + Pd ≥ 99.50%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts cm^{-1}K^{-1}]

T	k
CURVE 1	
298.2	0.320
CURVE 2	
298.2	0.450
CURVE 3	
298.2	0.570
CURVE 4	
298.2	0.840
CURVE 5	
298.2	1.410
CURVE 6	
2.15	0.0578
2.30	0.0614
2.66	0.0723
3.15	0.0959
3.65	0.115
3.99	0.118
4.27	0.142
5.65	0.196
5.97	0.203
7.34	0.265
8.32	0.303
9.49	0.354
11.1	0.420
14.1	0.550
18.2	0.691
22.7	0.829
28.6	0.976
35.8	1.05
56.7	1.33
66.6	1.44
75.1	1.53
82.8	1.61
85.2	1.63
90.7	1.70
CURVE 6 (cont.)	
91.5	1.70
111.7	1.92
CURVE 7	
1.84	0.0482
2.20	0.0562
2.63	0.0676
3.33	0.0845
3.70	0.0956
4.25	0.110
4.27	0.114
4.75	0.124
4.74	0.118
5.31	0.141
7.36	0.200
9.00	0.246
10.5	0.286
11.4	0.319
13.5	0.382
14.1	0.399
16.0	0.461
17.8	0.514
22.8	0.653
30.8	0.836
59.5	1.27
66.4	1.35
73.0	1.42
80.6	1.52
85.6	1.58
90.5	1.65
91.0	1.63
104.0	1.77
117.2	1.80
127.8	1.99
CURVE 8	
1.94	0.0248
2.32	0.0307
2.67	0.0360
3.18	0.0450
3.65	0.0541
4.27	0.0691
CURVE 8 (cont.)	
6.21	0.110
6.55	0.121
6.85	0.121
7.02	0.119
7.72	0.140
9.51	0.170
10.5	0.204
12.3	0.235
14.4	0.286
16.4	0.325
20.9	0.405
25.1	0.477
30.6	0.514
33.8	0.534
36.7	0.540
57.1	0.696
57.4	0.717
65.6	0.764
72.0	0.816
72.4	0.832
80.9	0.880
91.0	0.954
91.2	0.963
110.0	1.09
121.1	1.15
129.7	1.23
136.6	1.29
147.0	1.33
CURVE 9	
1.95	0.0131
2.20	0.0155
2.66	0.0197
3.06	0.0236
3.52	0.0284
3.87	0.0326
4.28	0.0370
6.24	0.0666
6.81	0.0715
7.24	0.0776
8.23	0.0919
9.34	0.108
10.9	0.133
CURVE 9 (cont.)	
14.0	0.175
16.7	0.208
20.4	0.242
24.7	0.277
29.7	0.313
34.0	0.330
54.9	0.412
59.7	0.444
59.8	0.439
77.9	0.520
91.1	0.580
104.0	0.644
105.6	0.645
115.4	0.684
125.3	0.728
138.3	0.781
146.7	0.826
148.6	0.820
150.4	0.848
CURVE 10	
2.34	0.0102
2.01	0.0082
2.89	0.0138
3.25	0.0165
3.62	0.0194
3.89	0.0218
4.27	0.0250
5.81	0.0415
6.09	0.0417
6.48	0.0494
7.12	0.0559
9.13	0.0802
11.2	0.102
14.1	0.134
17.6	0.163
26.1	0.214
37.9	0.226
55.2	0.273
60.5	0.281
65.4	0.292
69.8	0.302
81.6	0.326
CURVE 10 (cont.)	
90.8	0.360
110.6	0.392
120.6	0.424
135.1	0.453
138.1	0.480
156.8	0.510
CURVE 11	
2.11	0.0092
2.42	0.0111
2.75	0.0134
2.78	0.0134
2.89	0.0145
3.06	0.0159
3.18	0.0169
3.30	0.0178
3.47	0.0194
3.56	0.2603
3.62	0.0207
3.87	0.2300
3.90	0.0231
4.02	0.0247
4.27	0.0271
4.28	0.0265
6.66	0.0572
7.46	0.0652
9.11	0.0851
11.3	0.110
14.8	0.146
20.2	0.185
27.9	0.223
55.5	0.275
55.6	0.270
60.7	0.286
61.1	0.282
71.1	0.304
75.3	0.315
86.8	0.318
90.8	0.352
91.0	0.355
91.2	0.347
119.7	0.426
121.5	0.413
147.1	0.486
CURVE 12	
2.24	0.00761
2.52	0.00917
2.74	0.0104
3.42	0.0148
3.80	0.0179
4.27	0.0215
6.87	0.0550
9.81	0.0855
16.3	0.144
19.6	0.166
23.6	0.187
28.3	0.202
32.9	0.209
60.6	0.229
70.2	0.238
81.0	0.248
90.9	0.265
91.0	0.262
110.4	0.284
123.2	0.304
130.0	0.323
145.1	0.345
CURVE 13	
1.90	0.00650
2.40	0.00922
2.85	0.0123
3.11	0.0143
3.29	0.0158
3.67	0.0194
3.87	0.0211
4.27	0.0256
4.28	0.0253
5.73	0.0416
6.39	0.0477
8.12	0.0683
9.99	0.0906
14.1	0.130
19.7	0.167
23.6	0.182
27.5	0.196
61.7	0.203
71.2	0.208
80.8	0.213
CURVE 13 (cont.)	
91.0	0.220
116.7	0.245
128.4	0.258
150.5	0.282
CURVE 14	
1.81	0.00546
2.31	0.00725
2.82	0.00991
3.17	0.0119
3.43	0.0134
3.83	0.0159
4.01	0.0171
4.27	0.0188
4.65	0.0220
5.34	0.0276
5.99	0.0315
7.08	0.0395
8.99	0.0528
11.2	0.0684
14.1	0.0864
18.0	0.105
22.6	0.124
27.6	0.136
61.4	0.162
75.6	0.168
91.3	0.172
117.2	0.191
CURVE 15	
448.2	0.251

SPECIFICATION TABLE NO. 191 THERMAL CONDUCTIVITY OF [SILVER + PLATINUM] ALLOYS

(Ag + Pt ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Pt	Composition (continued), Specifications and Remarks
1	241	E	1911	298			90.0	10.0	
2	241	E	1911	298			75.0	25.0	
3	241	E	1911	298			70.0	30.0	
4	241	E	1911	298			67.0	33.0	
5	390	P	1956	521.2			50.0	50.0	

DATA TABLE NO. 191 THERMAL CONDUCTIVITY OF [SILVER + PLATINUM] ALLOYS

(Ag + Pt ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
298	0.98
CURVE 2*	
298	0.38
CURVE 3*	
298	0.31
CURVE 4*	
298	0.30
CURVE 5	
521.2	0.272

* No graphical presentation

SPECIFICATION TABLE NO. 195 THERMAL CONDUCTIVITY OF (SILVER + TIN) ALLOYS

(Ag + Sn ≥ 99.50%, impurity < 0.20 each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Sn	Composition (continued), Specifications and Remarks
1	230	L	1925	333.2			90.0	10.0	
2	230	L	1925	333.2			80.0	20.0	
3	230	L	1925	333.2			70.0	30.0	
4	230	L	1925	333.2			60.0	40.0	
5	230	L	1925	333.2			50.0	50.0	

DATA TABLE NO. 195 THERMAL CONDUCTIVITY OF (SILVER + TIN) ALLOYS

(Ag + Sn ≥ 99.50%, impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k
CURVE 1*		**CURVE 5***	
333.2	0.297	333.2	0.577
CURVE 2*			
333.2	0.197		
CURVE 3*			
333.2	0.393		
CURVE 4*			
333.2	0.490		

* No graphical presentation

THERMAL CONDUCTIVITY OF SILVER + ZINC ALLOYS

[Ag + Zn ≥ 99.50%; impurity ≤ 0.20% each]

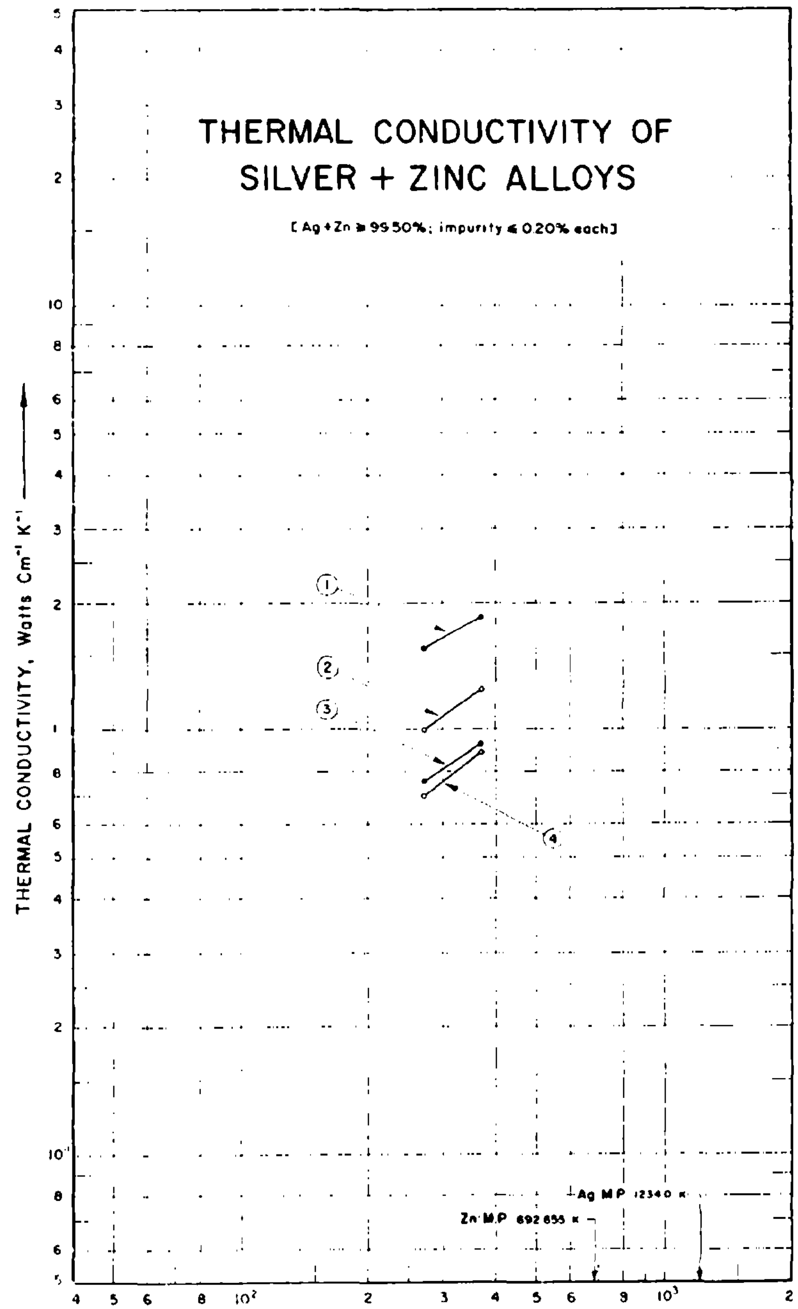


FIG 196

SPECIFICATION TABLE NO. 196 THERMAL CONDUCTIVITY OF [SILVER + ZINC] ALLOYS

(Ag + Zn = 99.50%; impurity 0.20% each)

[For Data Reported in Figure and Table No. 196]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Zn	Composition (continued), Specifications and Remarks
1	246	T	1919	273,373			96.47	3.53	Calculated composition; specimen rolled and drawn to wire 1 mm thick; heated to near melting point for 0.5 hr; electrical conductivity 21.4 and 19.5 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.
2	246	T	1919	273,373			92.63	7.37	Similar to the above specimen except electrical conductivity 15.5 and 13.0 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.
3	246	T	1919	273,373			86.93	13.07	Similar to the above specimen except electrical conductivity 9.3 and 9.2 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.
4	246	T	1919	273,373			81.06	18.94	Similar to the above specimen except electrical conductivity 8.1 and 8.2 x 10^4 $ohm^{-1}cm^{-1}$ at 0 and 100 C, respectively.

DATA TABLE NO. 196 THERMAL CONDUCTIVITY OF (SILVER + ZINC) ALLOYS

(Ag + Zn ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
273.2	1.56
373.2	1.85
CURVE 2	
273.2	1.00
373.2	1.27
CURVE 3	
273.2	0.76
373.2	0.93
CURVE 4	
273.2	0.70
373.2	0.89

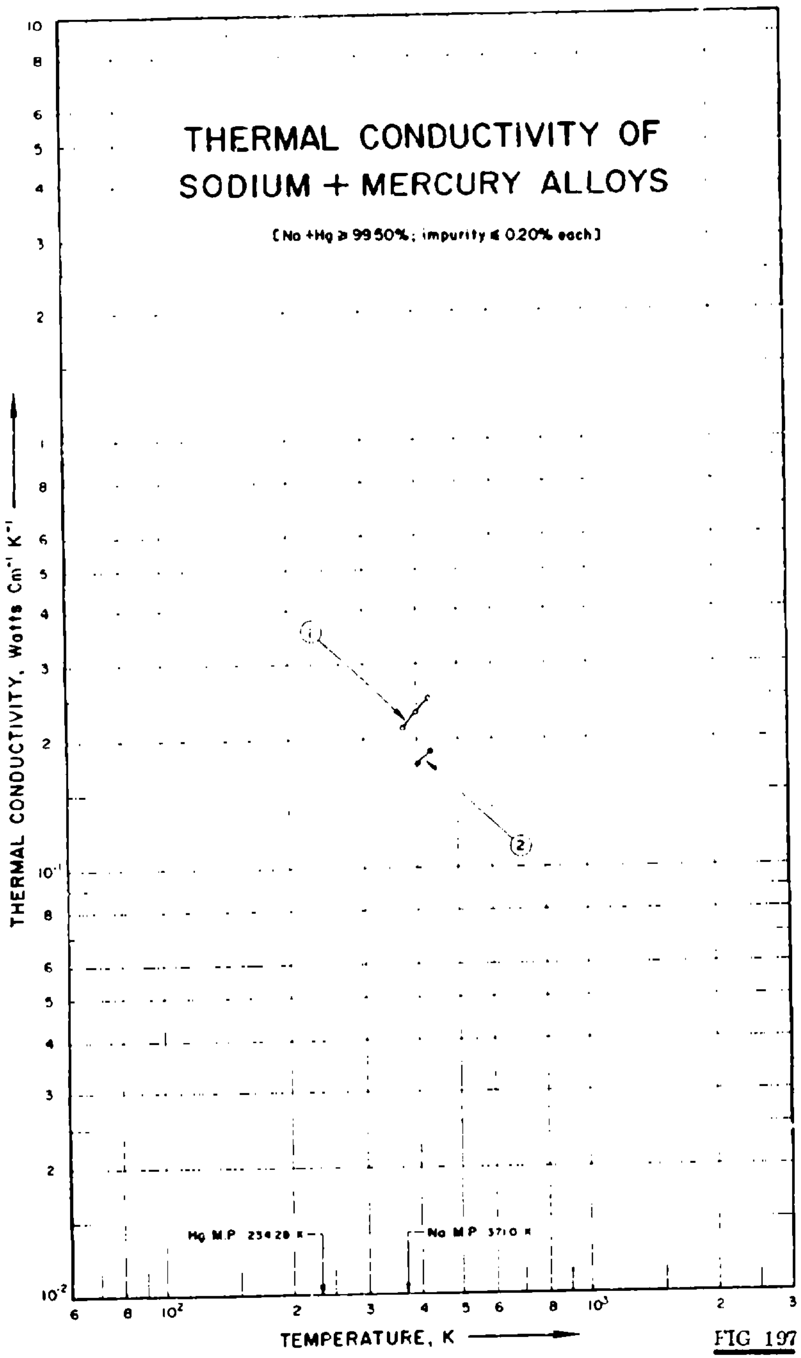

THERMAL CONDUCTIVITY OF
SODIUM + MERCURY ALLOYS
[Na + Hg ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Hg M.P. 234.28 K
Na M.P. 371.0 K
1
2

FIG 197

SPECIFICATION TABLE NO. 197 THERMAL CONDUCTIVITY OF [SODIUM + MERCURY] ALLOYS

(Na + Hg ≥ 99.50%; impurity ≤ 0.20%)

[For Data Reported in Figure and Table No. 197]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Na	Hg	Composition (continued), Specifications and Remarks
1	65	L	1938	373-429	< 3.0		63.03	36.97	Calculated composition; pure; supplied by Mallinckrodt Chemical Co.; in liquid state.
2	65	L	1938	405, 434	< 3.0		52.50	47.50	Similar to the above specimen.

DATA TABLE NO. 197 THERMAL CONDUCTIVITY OF [SODIUM + MERCURY] ALLOYS

(Na + Hg ≥ 99.50%; impurity ≤ 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
373.4	0.213
399.8	0.232
429.0	0.249
CURVE 2	
404.6	0.175
433.5	0.187

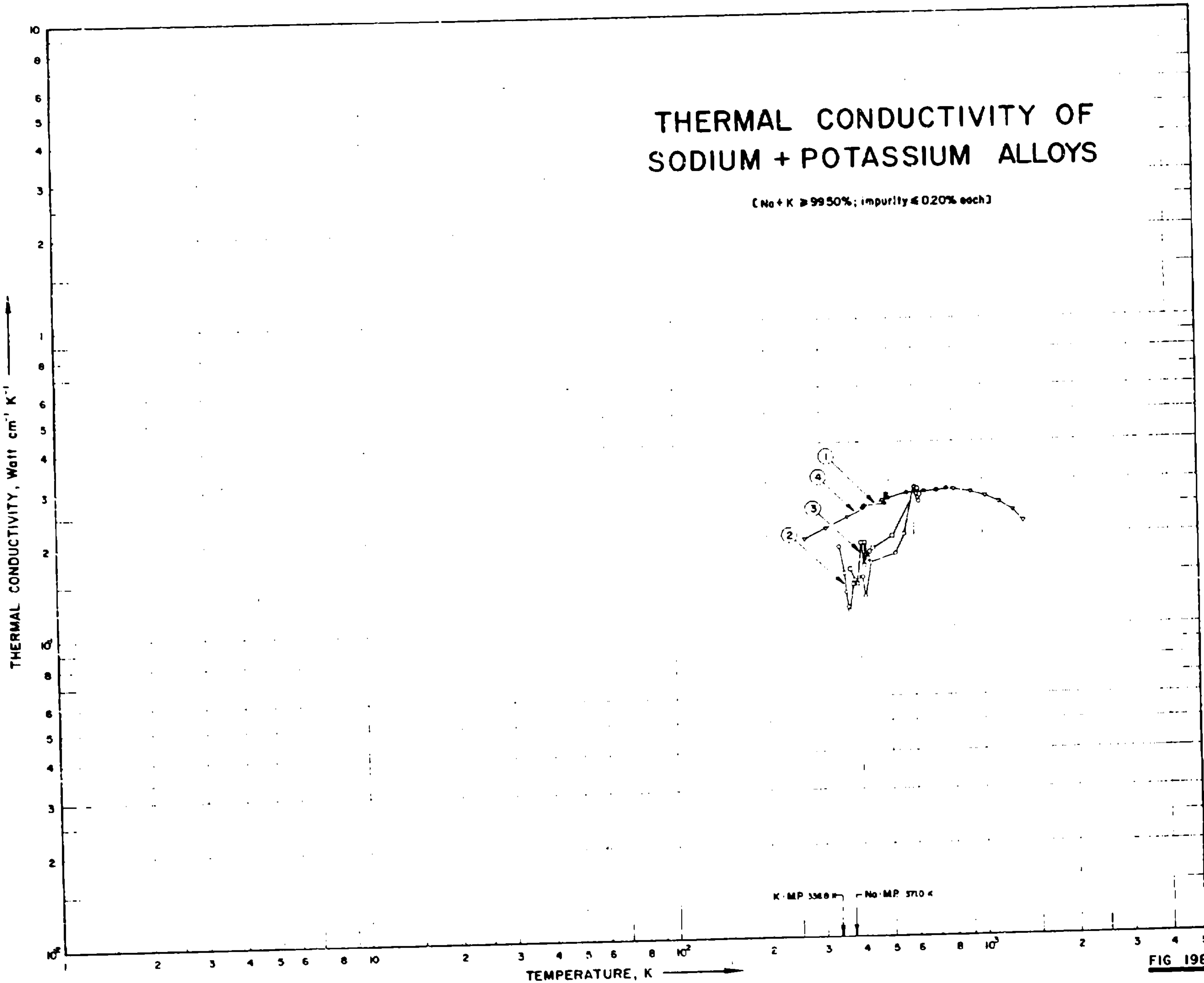

THERMAL CONDUCTIVITY OF SODIUM + POTASSIUM ALLOYS
[Na + K ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
K·MP 336.8 K
Na·MP 371.0 K
1
2
3
4

FIG 198

SPECIFICATION TABLE NO. 198 THERMAL CONDUCTIVITY OF [SODIUM + POTASSIUM] ALLOYS

(Na + K > 99.50%, impurity < 0.20% each)

[For Data Reported in Figure and Table No. 198]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Na	K	Composition (continued), Specifications and Remarks
1	242	C	1946	412-770			51.7	48.3	Commercially pure; in liquid state; stainless steel used as comparative material (thermal conductivity ~0.2 watt cm^{-1} C^{-1}).
2	243	L	1950	347-621		Na K			Eutectic composition; prepared from commercially pure Na and K; in liquid state (melting point -12.5 C).
3	243	L	1950	373-622		Na K			The above specimen solidified and then remelted.
4	859, 861	-	1965	266-1366		Na K			Eutectic composition; electrical resistivity reported as 36.26 ~151.28 μohm cm in the range 310 ~1363 K; thermal conductivity data calculated from measured electrical resistivity values and the Lorenz number 2.45 x 10^{-8} W ohm K^{-2}.

DATA TABLE NO. 198 THERMAL CONDUCTIVITY OF [SODIUM + POTASSIUM] ALLOYS

(Na + K > 99.50%, impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
412.20	0.245
415.80	0.249
484.50	0.254
489.30	0.271
495.80	0.263
497.00	0.261*
570.90	0.274
653.00	0.276
714.80	0.278
769.70	0.282
CURVE 2	
346.70	0.184
355.20	0.151
360.20	0.130
363.20	0.130*
366.50	0.117
369.90	0.113
381.20	0.138
397.20	0.146
409.80	0.146
417.20	0.126
435.20	0.163
524.20	0.172
559.20	0.201
560.20	0.192*
505.20	0.285
611.20	0.272
618.20	0.264
621.20	0.255
CURVE 3	
373.20	0.155
395.20	0.142
392.20	0.138
406.20	0.188
413.20	0.159
414.20	0.188
423.20	0.167
CURVE 3 (cont.)	
431.20	0.176
441.20	0.180
512.20	0.197
512.20	0.197*
612.20	0.240
622.20	0.268
CURVE 4	
266	0.154
311	0.210
366	0.227
478	0.257
589	0.274*
700	0.279*
811	0.278
922	0.273
1033	0.264
1144	0.252
1255	0.236
1366	0.218

* Not shown on plot

SPECIFICATION TABLE NO. 199 THERMAL CONDUCTIVITY OF [TANTALUM + NIOBIUM] ALLOYS

(Ta + Nb > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ta	Nb	Composition (continued), Specifications and Remarks
1	308	L	1966	1208-2900	± 12		99.61	0.33	0.02 Mo, 0.014 W, < 0.01 each of Fe, Si, and Ti; specimen 7.28 mm in dia and 65.8 mm long; prepared from a bar produced by electron-beam melting in vacuum; density 16.57 g cm^{-3} at 20 C; electrical resistivity reported as 54.8, 63.3, 64.5, 72.4, 80.7, 90.5, 100.4 and 105.2 μ ohm cm at 1243, 1488, 1512, 1750, 2010, 2350, 2623, and 2782 K, respectively.

DATA TABLE NO. 199 THERMAL CONDUCTIVITY OF [TANTALUM + NIOBIUM] ALLOYS

(Ta + Nb > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k	T	k
CURVE 1*		CURVE 1 (cont.)*	
1208	0.557	2160	0.604
1250	0.510	2275	0.604
1280	0.522	2360	0.621
1306	0.572	3393	0.629
1350	0.547	2506	0.635
1410	0.545	2695	0.651
1460	0.606	2906	0.663
1490	0.549	2900	0.684
1505	0.572		
1545	0.596		
1560	0.621		
1606	0.594		
1670	0.586		
1862	0.586		
2032	0.602		
2060	0.602		

* No graphical presentation

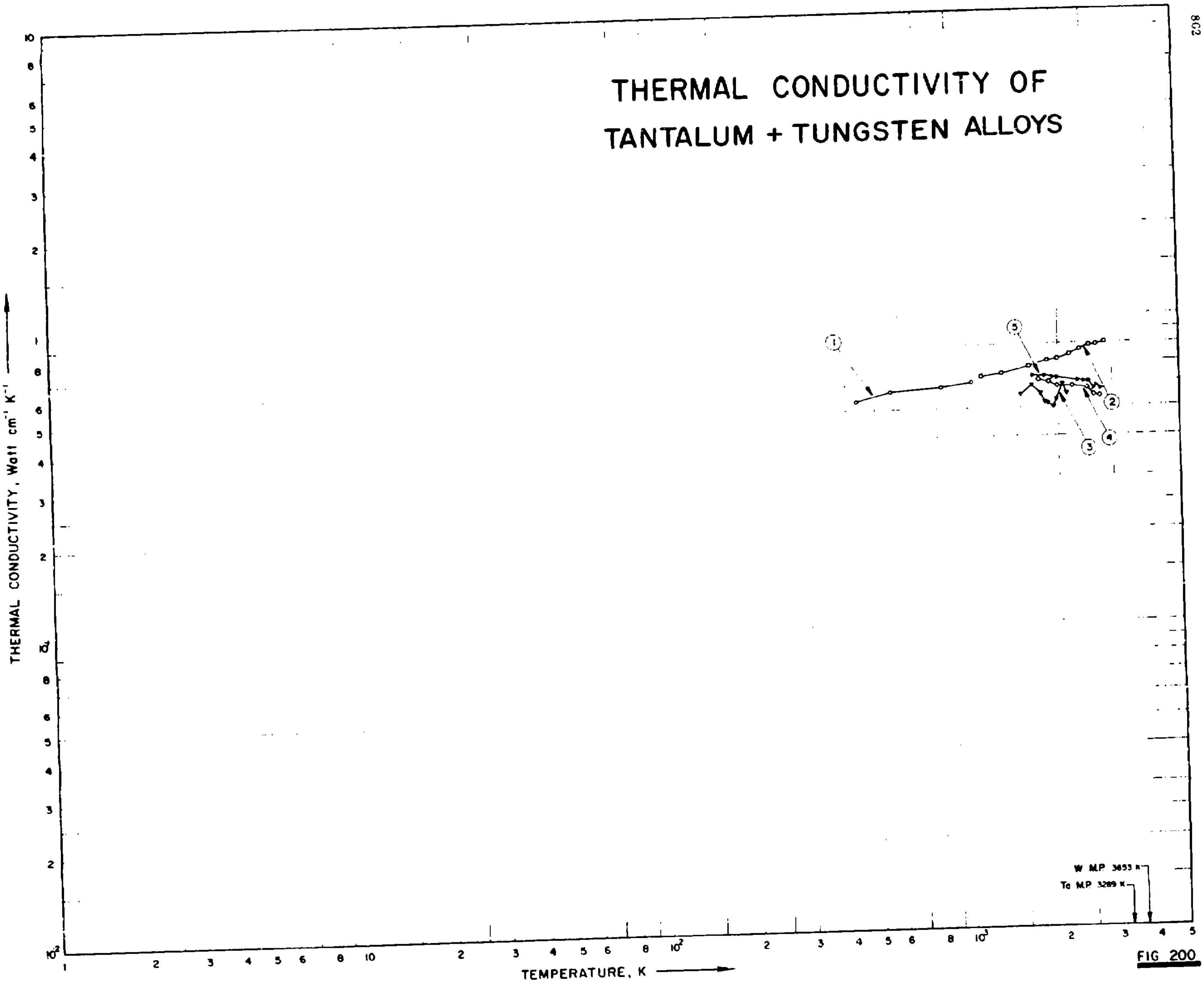

THERMAL CONDUCTIVITY OF
TANTALUM + TUNGSTEN ALLOYS
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
W M.P. 3653 K
Ta M.P. 3269 K
1
2
3
4
5

FIG 200

SPECIFICATION TABLE NO. 200 THERMAL CONDUCTIVITY OF [TANTALUM + TUNGSTEN] ALLOYS

(Ta + W ≥ 99.50%; impurity ≤ 0.20%)

[For Data Reported in Figure and Table No. 200]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ta	W	Composition (continued), Specifications and Remarks
1	583	C	1963	435-1049	±4		90.43	9.40	Impurities: 0.10 Nb, 0.02 Si, 0.02 Ti, 0.01 Mo, 0.01 Ni, 0.005 Fe, and 0.004 C; specimen 2 in. dia, 1 in. long; measured in an He atmosphere; Armco iron as standard.
2	583	P	1963	1122-2850	±4		90.43	9.40	The above specimen measured by another method.
3	849	-	1966	1514-2130		Ta-10 W; No. 1	Bal.	9.0	0.0025 C and 0.002 O; specimen 2.1265 cm in dia and 0.3254 cm long; density 16.91 g cm^{-3}; thermal conductivity was derived from the temp distribution on the flat surface of the cylindrical disc specimen heated in high vacuum (10^{-6} mm Hg) by high frequency induction generating localized heating within 0.003 in. of the surface at current frequency of 500,000 cps with heat lost only by radiation; the cylindrical surface being assumed isothermal, and the temp gradient along the radius was analytically correlated to the thermal conductivity.
4	849	-	1966	1731-2742		Ta-10 W; No. 2	Bal	9.9	0.0025 C and 0.002 O; similar to the above specimen except specimen 2.1251 cm in dia and 0.3145 cm long.
5	849	-	1966	1652-2756		T 111; No. 1	Bal.	7.8	2.0 Hf, 0.0034 O, 0.0023 N, 0.0022 C and 0.0005 H; cut from the same bar as the above specimen; specimen 2.5476 cm in dia and 0.2504 cm long; density 16.73 g cm^{-3}; measuring method same as that for the above specimen.
6	849	-	1966	1524-2082		T 111; No. 2	Bal.	7.8	2.0 Hf, 0.0034 O, 0.0023 N, 0.0022 C, and 0.0005 H; similar to the above specimen.

DATA TABLE NO. 200 THERMAL CONDUCTIVITY OF [TANTALUM + TUNGSTEN] ALLOYS

(Ta + W > 99.50%; Impurity < 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
435.4	0.537
565.9	0.571
828.2	0.588
1048.7	0.604
CURVE 2	
1122.1	0.630
1313.7	0.644
1608.2	0.677
1849.8	0.701
1997.1	0.713
2188.7	0.736
2369.3	0.762
2538.7	0.781
2677.6	0.787
2849.8	0.800
CURVE 3	
1514	0.546
1648	0.585
1753	0.552
1807	0.518
1857	0.516
1938	0.496
1973	0.526
2072	0.586
2130	0.547
CURVE 4	
1731	0.610
1868	0.599
1990.5	0.581
2075	0.582*
2238	0.580
2496	0.571
2619	0.542
2742	0.538
CURVE 5	
1652	0.628
1816	0.627
1912	0.617
1990.5	0.617
2103.5	0.596*
2324.5	0.600
2430	0.596
2520	0.595
2604	0.570
2671	0.579
2756	0.565
CURVE 6*	
1524	0.675
1585	0.627
1685	0.686
1800	0.626
1808	0.622
1915	0.647
1962	0.592
2022	0.557
2082	0.586

* Not shown on plot

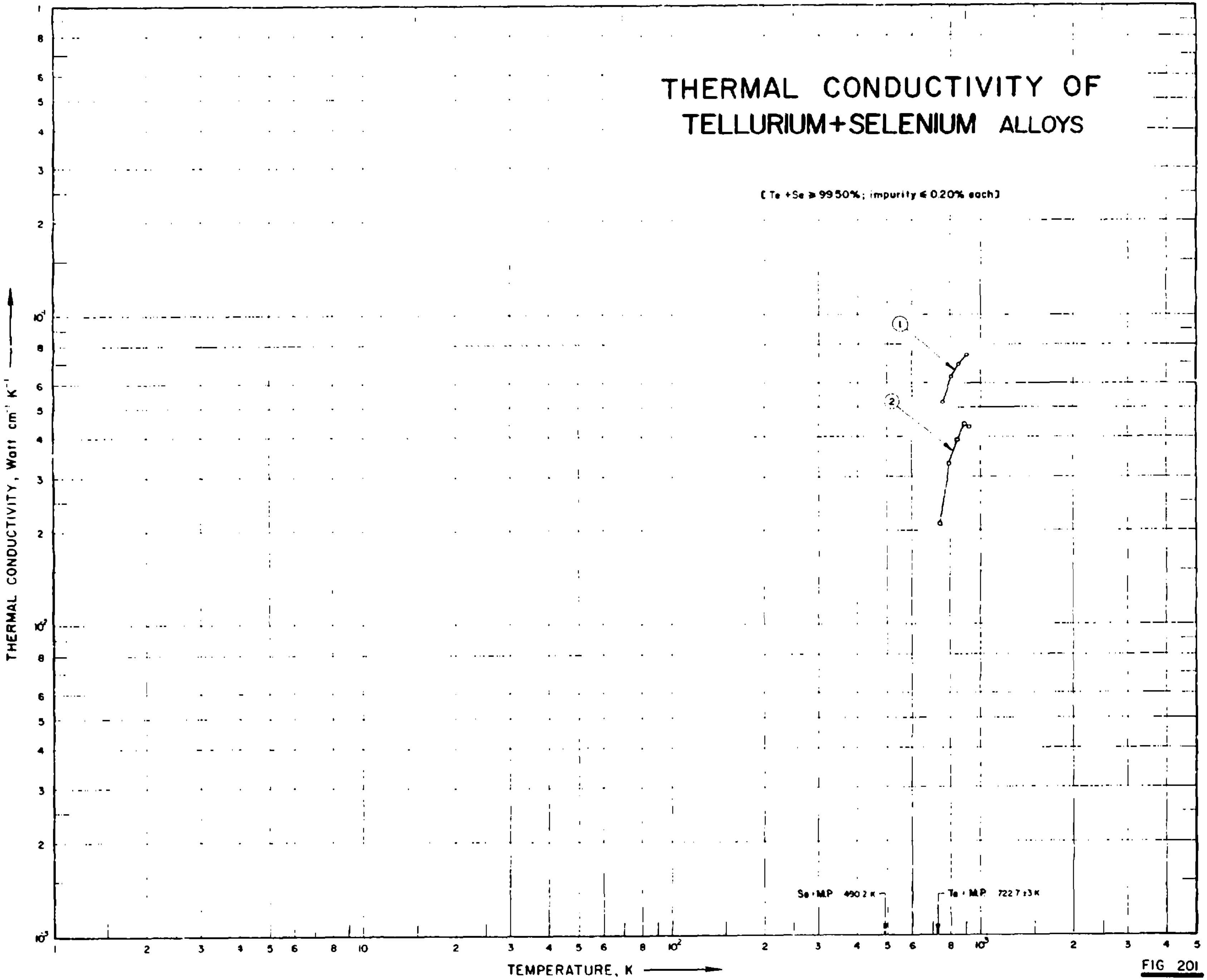

THERMAL CONDUCTIVITY OF TELLURIUM+SELENIUM ALLOYS
[Te + Se ≥ 99.50%; impurity ≤ 0.20% each]
Se : M.P. 490.2 K
Te : M.P. 722.7 ± 3 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2

FIG 201

SPECIFICATION TABLE NO. 201 THERMAL CONDUCTIVITY OF [TELLURIUM + SELENIUM] ALLOYS

(Te + Se ≥99.50%; impurity ≤0.20%)

[For Data Reported in Figure and Table No. 201]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Te	Se	Composition (continued), Specifications and Remarks
1	914	L	1966	753-904			96.85	3.15	Prepared from 99.995 pure Te and 99.9985 pure Se; molten specimen contained in a short cylindrical cell.
2	914	L	1966	742-923			86.60	13.40	Similar to the above specimen.

DATA TABLE NO. 201 THERMAL CONDUCTIVITY OF [TELLURIUM + SELENIUM] ALLOYS

(Te + Se > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
753	0.052
805	0.063
850	0.069
904	0.074
CURVE 2	
742	0.021
794	0.033
843	0.039
893	0.044
923	0.043

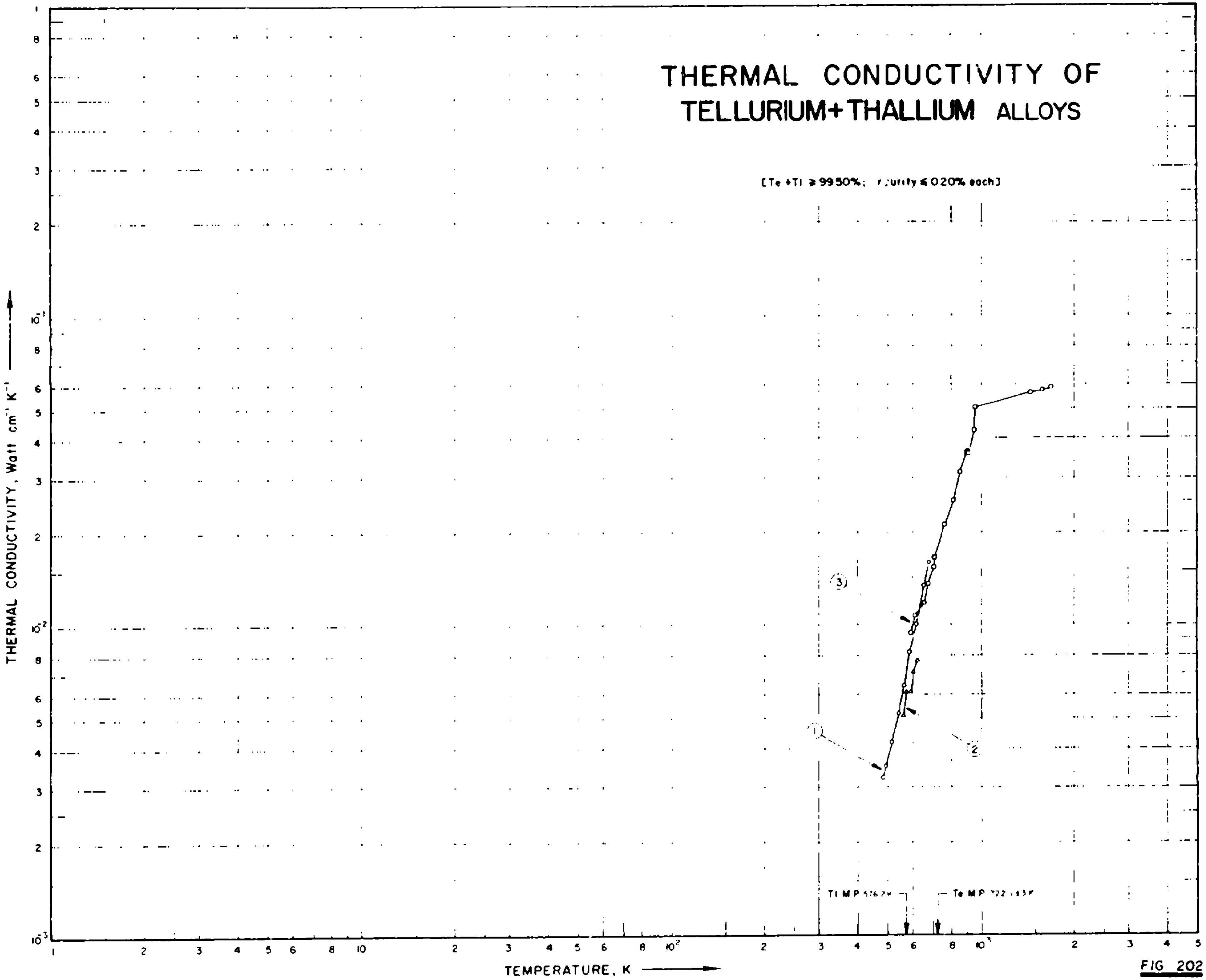

THERMAL CONDUCTIVITY OF
TELLURIUM+THALLIUM ALLOYS
[Te+Tl ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Tl M.P. 576.2 K
Te M.P. 722.7 K
1
2
3

FIG. 202

SPECIFICATION TABLE NO. 202 THERMAL CONDUCTIVITY OF [TELLURIUM + THALLIUM] ALLOYS

(Te + Tl > 99.50%; impurity < 0.20%)

[For Data Reported in Figure and Table No. 202]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Te	Tl	Composition (continued), Specifications and Remarks
1	927	E	1965	483-680			69	31	p-type; electrical resistivity 9.79, 2.80, 1.60, and 1.44 x 10^{-2} ohm cm at 205, 302, 401, and 430 C respectively; measured by the neck-down sample method.
2	927	E	1965	561-627			58	42	p-type; electrical resistivity 4.33, 3.61, and 2.69 x 10^{-3} ohm cm at 286, 310, and 378 C respectively; measured by the neck-down sample method.
3	927	E	1965	594-1068			52	48	p-type; electrical resistivity 4.24, 2.79, 1.93, 1.62, and 1.26 x 10^{-3} ohm cm at 321, 424, 527, 620, and 796 C respectively; measured by the neck-down sample method.

DATA TABLE NO. 202 THERMAL CONDUCTIVITY OF [TELLURIUM + THALLIUM] ALLOYS

(Te + Tl ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
483.2	0.0032
492.2	0.0035
515.2	0.0042
541.2	0.0052
569.2	0.0064
588.2	0.0082
620.2	0.0100
653.2	0.0135
680.2	0.0161
CURVE 2	
561.2	0.0051
576.2	0.0061
592.2	0.006[illegible]
607.2	0.0071
627.2	0.00[illegible]
CURVE 3	
594.2	0.0094
617.2	0.0107
657.2	0.011[illegible]
672.2	0.0136
701.2	0.0154
709.2	0.0166
762.2	[illegible]
814.2	0.0252
855.2	0.0314
902.2	0.0364
910.2	0.0361
930.2	0.0441
959.2	0.0505
1045.2	0.0568
1058.2	0.0576
1068.2	0.0583

SPECIFICATION TABLE NO. 203 THERMAL CONDUCTIVITY OF [THALLIUM + CADMIUM] ALLOYS

(Tl + Cd > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Tl	Cd	Composition (continued), Specifications and Remarks
1	230	L	1925	336.2			90.0	10.0	Impurities < 0.03.
2	230	L	1925	336.2			80.0	20.0	Impurities < 0.03.
3	230	L	1925	336.2			70.0	30.0	Impurities < 0.03.
4	230	L	1925	336.2			60.0	40.0	Impurities < 0.03.
5	230	L	1925	336.2			50.0	50.0	Impurities < 0.03.

DATA TABLE NO. 203 THERMAL CONDUCTIVITY OF [THALLIUM + CADMIUM] ALLOYS

(Tl + Cd) > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 5*	
336.2	0.444	336.2	0.661
CURVE 2*			
336.2	0.494		
CURVE 3*			
336.2	0.536		
CURVE 4*			
336.2	0.582		

* No graphical presentation

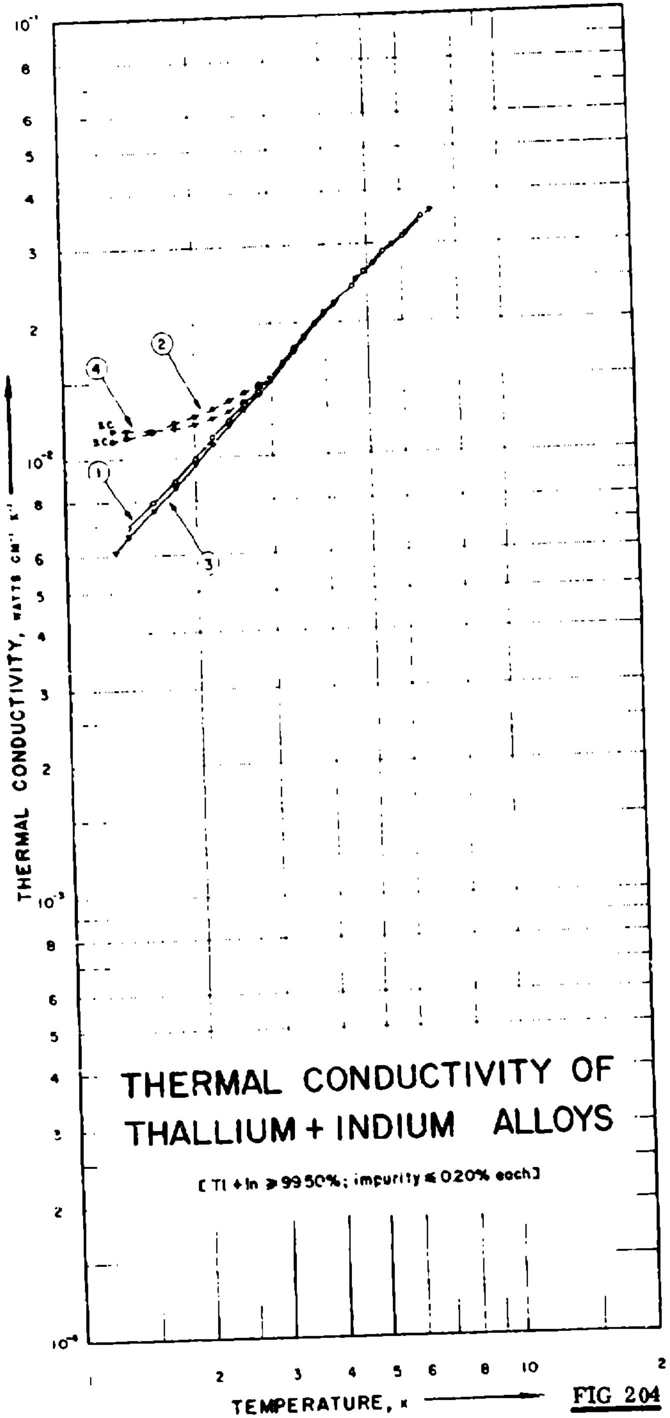

THERMAL CONDUCTIVITY OF
THALLIUM + INDIUM ALLOYS
[Tl + In ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
4

FIG 204

SPECIFICATION TABLE NO. 204 THERMAL CONDUCTIVITY OF [THALLIUM + INDIUM] ALLOYS

(Tl + In ≥ 99.50%; impurity ≤ 0.20%)

[For Data Reported in Figure and Table No. 204]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Tl	In	Composition (continued), Specifications and Remarks
1	132	L	1955	1.3-6.7	2.5		52.17	47.83	Calculated composition; < 0.05 impurities; annealed poly-crystal; measured under vacuo of $\sim 5 \times 10^{[illegible]}$ mm Hg and in a longitudinal magnetic field; in normal state.
2	132	L	1955	1.3-2.8	2.5		52.17	47.83	The above specimen in superconducting state.
3	132	L	1955	1.3-7.0	2.5		64.03	35.97	Calculated composition; < 0.05 imperities; annealed poly-crystal; measured in a longitudinal magnetic field and under vacuo of $\sim 5 \times 10^{-5}$ mm Hg; in normal state.
4	132	L	1955	1.3-2.6	2.5		64.03	35.97	The above specimen in superconducting state.

DATA TABLE NO. 208 THERMAL CONDUCTIVITY OF [THALLIUM + INDIUM] ALLOYS

(Tl + In > 99.50%; impurity < 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
1.30	0.0064
1.40	0.0069
1.60	0.0079
1.80	0.0089
2.00	0.0099
2.20	0.0110
2.40	0.0120
2.60	0.0131
2.80	0.0141
3.00	0.0152
3.20	0.0164
3.40	0.0175
3.60	0.0187
3.80	0.0200
4.00	0.0212
4.20	0.0224
4.67	0.0244
4.95	0.0261
5.48	0.0289
6.04	0.0314
6.71	0.0346
CURVE 2	
1.30	0.0109
1.40	0.0111
1.60	0.0114
1.80	0.0119
2.00	0.0123
2.20	0.0128
2.40	0.0134
2.60	0.0140
2.80	0.0146
CURVE 3	
1.30	0.0061
1.40	0.0068
1.60	0.0076
1.80	0.0086
2.00	0.0097
2.20	0.0107
CURVE 3 (cont.)	
2.40	0.0118
2.60	0.0128
2.80	0.0139
3.00	0.0151
3.20	0.0162
3.40	0.0174
3.60	0.0186
3.80	0.0198
4.00	0.0211
4.20	0.0223
4.74	0.0251
5.21	0.0272
5.74	0.0298
6.19	0.0318
7.01	0.0359
CURVE 4	
1.30	0.0115
1.40	0.0115
1.60	0.0115
1.80	0.0116
2.00	0.0118
2.20	0.0121
2.40	0.0126
2.60	0.0132

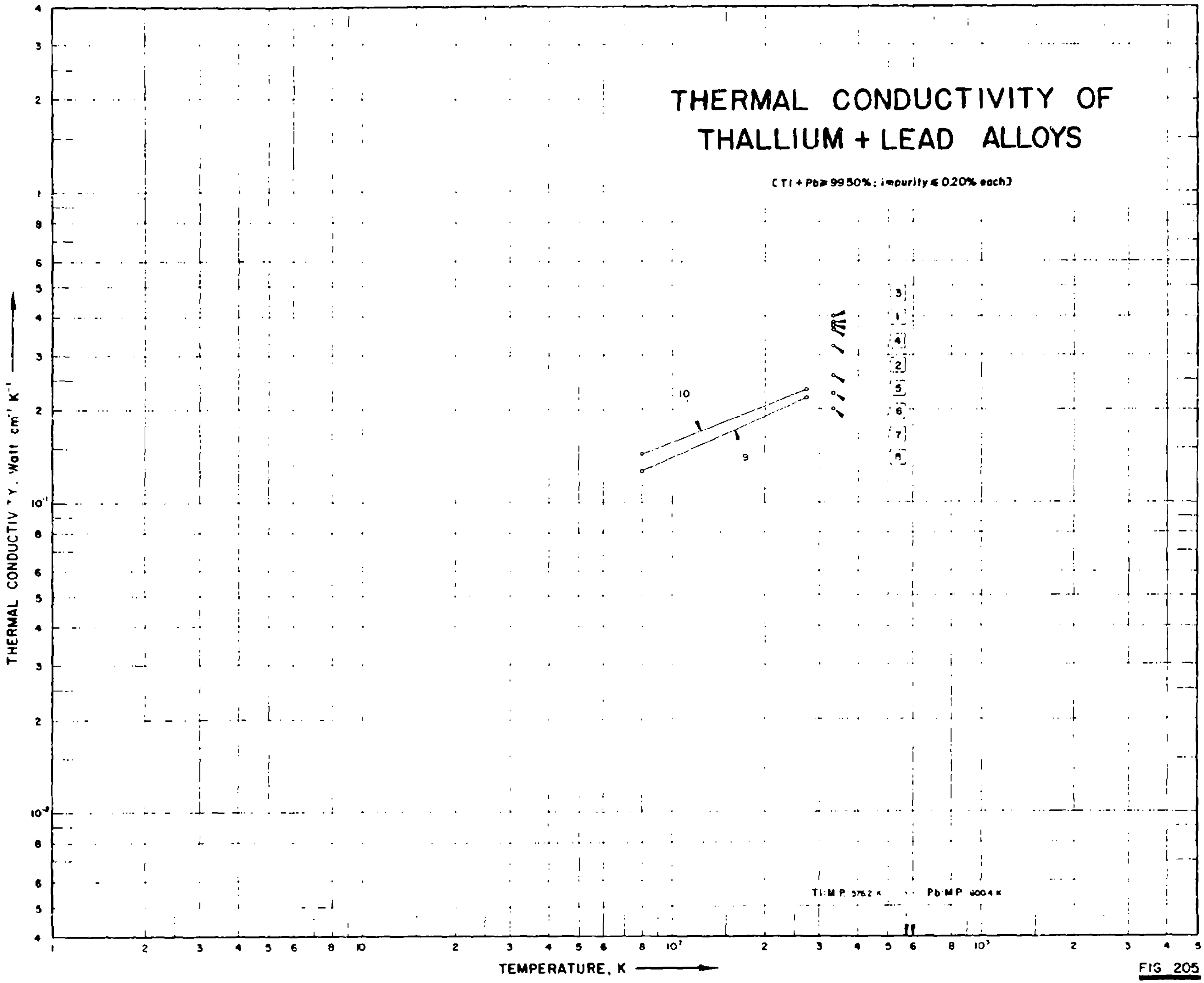

THERMAL CONDUCTIVITY OF
THALLIUM + LEAD ALLOYS
(Tl + Pb ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Tl: M.P. 576.2 K
Pb: M.P. 600.4 K
10
9
3
1
4
2
5
6
7
8

FIG 205

SPECIFICATION TABLE NO. 205 THERMAL CONDUCTIVITY OF [THALLIUM + LEAD] ALLOYS

(Tl + Pb > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 205]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Tl	Pb	Composition (continued), Specifications and Remarks
1	230	L	1925	333			98	2	Prepared from Pb (< 0.03 impurity, supplied by Baker) and Tl (technically pure, supplied by Eimer and Amend); specimen ~5.5 cm long, 0.3 cm^2 cross-sectional area; electrical conductivity at 25 C, σ(25 C) 4.95 x 10^4 $ohm^{-1}cm^{-1}$.
2	230	L	1925	333			96	4	Similar to the above specimen except σ(25 C) 4.72 x 10^4 $ohm^{-1}cm^{-1}$.
3	230	L	1925	333			94	6	Similar to the above specimen except σ(25 C) 5.16 x 10^4 $ohm^{-1}cm^{-1}$.
4	230	L	1925	333			90	10	Similar to the above specimen except σ (25 C) - 4.90 x 10^4 $ohm^{-1}cm^{-1}$.
5	230	L	1925	333			80	20	Similar to the above specimen except σ (25 C) - 4.02 x 10^4 $ohm^{-1}cm^{-1}$.
6	230	L	1925	333			70	30	Similar to the above specimen except σ (25 C) = 3.04 x 10^4 $ohm^{-1}cm^{-1}$.
7	230	L	1925	333			60	40	Similar to the above specimen except σ (25 C) 2.63 x 10^4 $ohm^{-1}cm^{-1}$.
8	230	L	1925	333			50	50	Similar to the above specimen except σ (25 C) - 2.63 x 10^4 $ohm^{-1}cm^{-1}$.
9	34	L	1927	80, 273		$PbTl_2$; I	66.0	34.0	Coarse grained; electrical conductivity 2.817 and 4.2 x 10^4 $ohm^{-1}cm^{-1}$ at 273 and 80 K, respectively.
10	34	L	1927	80, 273		$PbTl_2$; II	66.0	34.0	Fine grained; electrical conductivity 2.672 and 3.93 x 10^4 $ohm^{-1}cm^{-1}$ at 273 and 80 K, respectively.

DATA TABLE NO. 205 THERMAL CONDUCTIVITY OF [THALLIUM + LEAD] ALLOYS

(Tl + Pb $\geq$ 99.50%; impurity $\leq$ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
333	0.385
CURVE 2	
333	0.364
CURVE 3	
333	0.402
CURVE 4	
333	0.377
CURVE 5	
333	0.322
CURVE 6	
333	0.259
CURVE 7	
333	0.226
CURVE 8	
333	0.201
CURVE 9	
80	0.127
273	0.219
CURVE 10	
80	0.14*
273	0.232

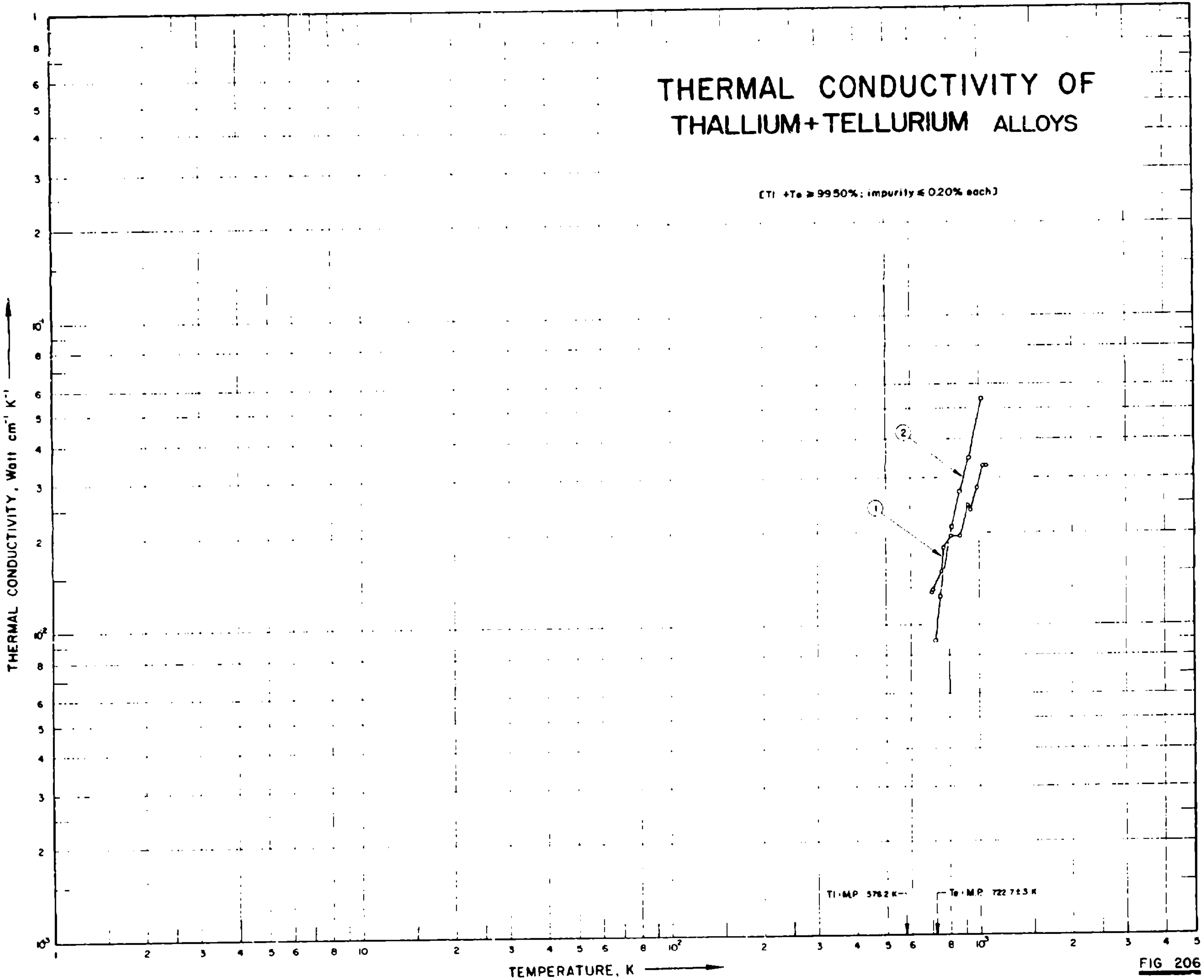

THERMAL CONDUCTIVITY OF
THALLIUM + TELLURIUM ALLOYS
[Tl + Te ≥ 99.50%; impurity ≤ 0.20% each]
Tl: M.P. 576.2 K
Te: M.P. 722.7 ± 3 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2

FIG 206

SPECIFICATION TABLE NO. 206 THERMAL CONDUCTIVITY OF [THALLIUM + TELLURIUM] ALLOYS

(Tl + Te ≥ 99.50%; impurity ≤ 0.20%)

For Data Reported in Figure and Table No. 206

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Tl	Te	Composition (continued), Specifications and Remarks
1	927	E	1965	701-1067			54	46	p-type; electrical resistivity 2.95, 2.29, 1.85, 1.71, and 1.58 x 10^{-3} ohm cm at 431, 533, 656, 713, and 769 C respectively; measured by the neck-down sample method.
2	927	E	1965	722-1024			68	32	n-type; electrical resistivity 1.51, 1.49, 1.42, and 1.21 x 10^{-3} ohm cm at 458, 540, 648, and 768 C respectively; measured by the neck-down sample method.

DATA TABLE NO. 206 THERMAL CONDUCTIVITY OF [THALLIUM + TELLURIUM] ALLOYS

(Tl + Te ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
701.2	0.0128
710.2	0.0131
757.2	0.0149
769.2	0.0178
811.2	0.0195
868.2	0.0195
925.2	0.0246
942.2	0.0237
985.2	0.0277
1041.2	0.0328
1067.2	0.0328
CURVE 2	
722.2	0.0089
748.2	0.0124
815.2	0.0209
869.2	0.0270
928.2	0.0347
1024.2	0.0537

SPECIFICATION TABLE NO. 207 THERMAL CONDUCTIVITY OF [THALLIUM + TIN] ALLOYS

(Tl + Sn > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Tl	Sn	Composition (continued), Specifications and Remarks
1	230	L	1925	336.2			90.0	10.0	Impurities < 0.03.
2	230	L	1925	336.2			80.0	20.0	Impurities < 0.03.
3	230	L	1925	336.2			70.0	30.0	Impurities < 0.03.
4	230	L	1925	336.2			60.0	40.0	Impurities < 0.03.
5	230	L	1925	336.2			53.4	46.6	Impurities < 0.03.
6	230	L	1925	336.2			50.0	50.0	Impurities < 0.03.

DATA TABLE NO. 207 THERMAL CONDUCTIVITY OF [THALLIUM + TIN] ALLOYS

(Tl + Sn > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 5*	
336.2	0.301	336.2	0.331
CURVE 2*		CURVE 6*	
336.2	0.255	336.2	0.372
CURVE 3*			
336.2	0.259		
CURVE 4*			
336.2	0.289		

* No graphical presentation

SPECIFICATION TABLE NO. 298 THERMAL CONDUCTIVITY OF [THORIUM + URANIUM] ALLOYS

(Th + U > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Th	U	Composition (continued), Specifications and Remarks
1	396	C	1954	293-673			97	3	

DATA TABLE NO. 298 THERMAL CONDUCTIVITY OF [THORIUM + URANIUM] ALLOYS

(Th + U > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
293.2	0.39
373.2	0.39
473.2	0.39
573.2	0.40
673.2	0.40

* No graphical presentation

SPECIFICATION TABLE NO. 209 THERMAL CONDUCTIVITY OF [TIN + ALUMINUM] ALLOYS

(Sn + Al > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Al	Composition (continued), Specifications and Remarks
1	230	L	1925	324.2			50.0	50.0	Impurities less than 0.03.
2	230	L	1925	324.2			60.0	40.0	Impurities less than 0.03.
3	230	L	1925	324.2			70.0	30.0	Impurities less than 0.03.
4	230	L	1925	324.2			80.0	20.0	Impurities less than 0.03.
5	230	L	1925	324.2			90.0	10.0	Impurities less than 0.03.

DATA TABLE NO. 209 THERMAL CONDUCTIVITY OF [TIN + ALUMINUM] ALLOYS

(Sn + Al > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 5*	
324.2	1.393	324.2	0.812
CURVE 2*			
324.2	1.255		
CURVE 3			
324.2	1.142		
CURVE 4*			
324.2	0.950		

* No graphical presentation

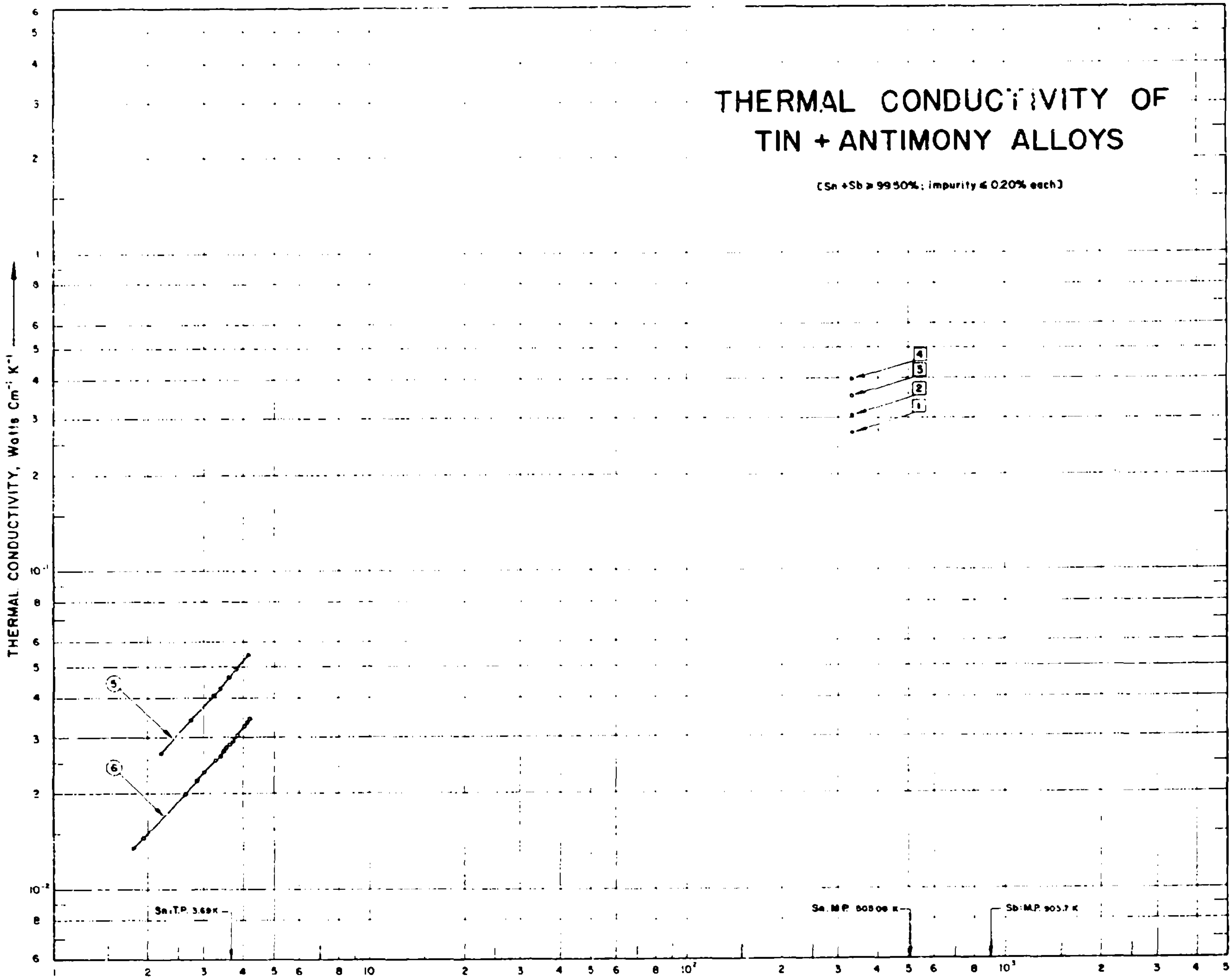

THERMAL CONDUCTIVITY OF
TIN + ANTIMONY ALLOYS
[Sn + Sb ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Sn: T.P. 3.69 K
Sn: M.P. 505.06 K
Sb: M.P. 903.7 K
1
2
3
4
5
6

FIG 210

SPECIFICATION TABLE NO. 210 THERMAL CONDUCTIVITY OF (TIN + ANTIMONY) ALLOYS

(Sn + Sb > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 210]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Sb	Composition (continued), Specifications and Remarks
1	230	L	1925	330.2			50	50	Prepared from Sn and Sb both containing < 0.03 impurities; supplied by Baker; specimen 10 cm long, 1.9 cm dia; electrical conductivity at 22 C, $\sigma(22C) = 3.46 \times 10^4$ ohm^{-1} cm^{-1}.
2	230	L	1925	330.2			60	40	Similar to the above specimen except $\sigma(22C) = 4.00 \times 10^4$ ohm^{-1} cm^{-1}.
3	230	L	1925	330.2			70	30	Similar to the above specimen except $\sigma(22C) = 4.59 \times 10^4$ ohm^{-1} cm^{-1}.
4	230	L	1925	330.2			80	20	Similar to the above specimen except $\sigma(22C) = 5.23 \times 10^4$ ohm^{-1} cm^{-1}.
5	315, 456	L	1957	2.2-4.2	2	4	97.03	2.97	Specimen ~4 mm dia, ~10 cm long; annealed for several months; electrical resistivity 2.142 and 1.605 μohm cm at 4.2 and 300 K, respectively; measured in a 560 gauss magnetic field; in normal state.
6	315, 456	L	1957	1.8-4.2	2	5	93.85	6.15	Similar to the above specimen except electrical resistivity 3.483 and 1.491 μohm cm at 4.2 and 300 K, respectively.

DATA TABLE NO. 210 THERMAL CONDUCTIVITY OF [TIN + ANTIMONY] ALLOYS

(Sn + Sb ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
330.2	0.268
CURVE 2	
330.2	0.305
CURVE 3	
330.2	0.352
CURVE 4	
330.2	0.398
CURVE 5	
2.20	0.0268
2.74	0.0339
3.23	0.0406
3.37	0.0427
3.60	0.0462
3.80	0.0491
4.17	0.0544
CURVE 6	
1.80	0.0134
1.94	0.0145
2.63	0.0198
2.86	0.0219
3.00	0.0233
3.26	0.0254
3.40	0.0261
3.46	0.0272
3.54	0.0279
3.63	0.0286
3.70	0.0293
3.83	0.0304
4.93	0.0325
4.11	0.0332
4.20	0.0342

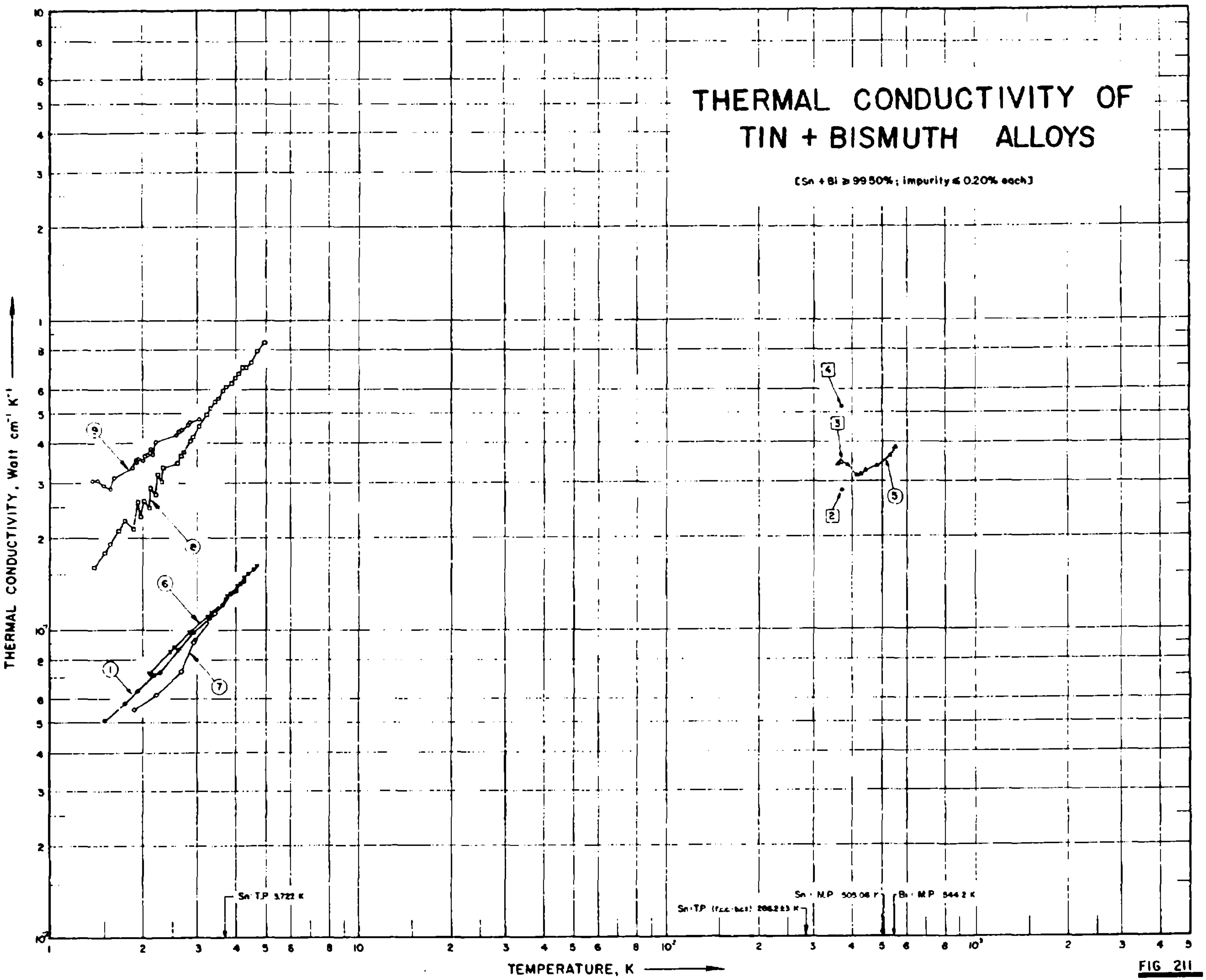

THERMAL CONDUCTIVITY OF
TIN + BISMUTH ALLOYS
[Sn + Bi ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Sn: T.P. 3.722 K
Sn: T.P. (f.c.c.-bct) 286.2 K
Sn: M.P. 505.06 K
Bi: M.P. 544.2 K
1
2
3
4
5
6
7
8
9

FIG 211

SPECIFICATION TABLE NO. 211 THERMAL CONDUCTIVITY OF [TIN + BISMUTH] ALLOYS

(Sn + Bi > 99.50%, impurity < 0.20% each)

[For Data Reported in Figure and Table No. 211]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Bi	Composition (continued), Specifications and Remarks
1	456	L	1958	1.5-4.2	2		98.08	1.92	Specimen ~4 mm dia. ~10 cm long; annealed for several months; measured in a 560 gauss magnetic field; in normal state.
2	460		1957	373.2			61	39	
3	460		1957	373.2			80	20	
4	460		1957	373.2			95	5	
5	514	L	1962	358-553	5		50	50	Prepared from 99.94 pure Sn; measured across melting point.
6	837	L	1967	3.1-4.7	1	Bi 3	98.46	1.54	Prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Bi, extruding into 1.5 mm dia wire annealed at ~200 C for several days; electrical resistivity 0.796 and 13.31 μohm cm at 4.2, and 273 K respectively; Tc 3700 K; normal-state data were taken at temperatures below Tc with a longitudinal magnetic field applied to the sample.
7	837	L	1967	1.9-3.4	1	Bi 3	98.46	1.54	Same as the above specimen except the magnetic field was removed so the superconducting-state data were taken.
8	836	L	1958	1.4-5.0	4-5	4	99.47	0.53	Prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Bi, casting into 1 mm dia x 12 cm long wire; electrical resistivity 0.230 μohm cm; a magnetic field was applied when taking normal-state data at temperatures below Tc.
9	836	L	1958	1.4-3.1	4-5	4	99.47	0.53	Same as the above specimen except the magnetic field was removed so the superconducting-state data were taken.

DATA TABLE NO. 211 THERMAL CONDUCTIVITY OF [TIN + BISMUTH] ALLOYS

(Sn + Bi > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
1.51	0.0503
1.76	0.0578
1.93	0.0637
2.18	0.0712
2.27	0.0729
2.60	0.0846
2.94	0.0980
3.28	0.109
3.61	0.121
3.99	0.133
4.24	0.142

CURVE 2

T	k
373.2	0.280

CURVE 3

T	k
373.2	0.345

CURVE 4

T	k
373.2	0.523

CURVE 5

T	k
358.2	0.339
373.2	0.343
388.2	0.339
418.2	0.314
428.2	0.314
443.2	0.322
483.2	0.335
533.2	0.360
553.2	0.385

CURVE 6

T	k
2.11	0.0728
2.47	0.0854
2.56	0.0884
2.86	0.0982
2.91	0.0990*
3.26	0.1105
3.33	0.1139*
3.36	0.1142
3.68	0.1252*
3.69	0.1266*
3.73	0.1261
3.79	0.1291
3.86	0.1311
4.04	0.1393*
4.08	0.1388
4.25	0.1454*
4.27	0.1463
4.42	0.1517*
4.43	0.1511
4.55	0.1573*
4.61	0.1567
4.67	0.1604

CURVE 7

T	k
1.88	0.0553
2.23	0.0618
2.67	0.0752
2.94	0.0909
2.96	0.0921
3.31	0.1086*
3.37	0.1115*
3.42	0.1147

CURVE 8

T	k
1.41	0.159
1.51	0.178
1.58	0.191
1.68	0.210
1.77	0.226
1.88	0.212
1.95	0.259
1.98	0.232
2.02	0.261
2.11	0.249
2.13	0.288
2.20	0.275
2.24	0.317
2.31	0.301
2.34	0.335
2.61	0.345
2.68	0.365
2.73	0.374
2.86	0.406
2.91	0.419
3.07	0.452
3.23	0.492
3.35	0.519
3.45	0.544
3.55	0.559
3.66	0.594
3.75	0.611
3.90	0.629
4.00	0.652
4.11	0.672
4.25	0.701
4.35	0.701
4.51	0.726
4.72	0.787
4.98	0.838

CURVE 9

T	k
1.39	0.304
1.45	0.304
1.50	0.293
1.58	0.286
1.63	0.310
1.87	0.334
1.92	0.354
1.93	0.346
1.97	0.358
2.01	0.351
2.04	0.364
2.08	0.367
2.14	0.384
2.17	0.368
2.21	0.401
2.59	0.425
2.65	0.436
2.69	0.441
2.81	0.459
2.85	0.466
3.06	0.477

* Not shown on plot

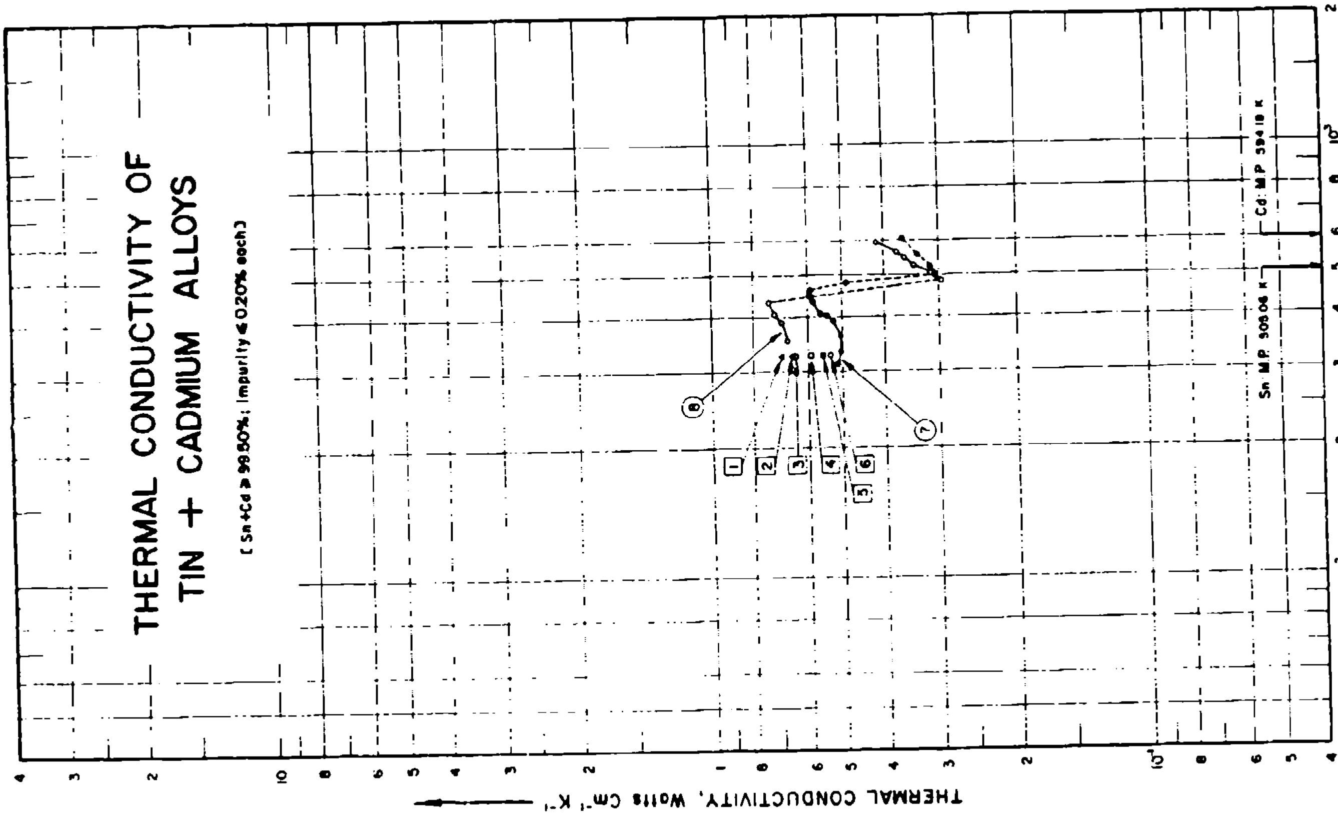

THERMAL CONDUCTIVITY OF
TIN + CADMIUM ALLOYS
[Sn+Cd ≥ 99.50%; Impurity ≤ 0.20% each]
Sn: M.P. 505.06 K
Cd: M.P. 594.18 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 212

SPECIFICATION TABLE NO. 212 THERMAL CONDUCTIVITY OF TIN + CADMIUM ALLOYS

(Sn + Cd ≥ 99.50%; impurity ≤ 0.20% each)

For Data Reported in Figure and Table No. 212

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Cd	Composition (continued), Specifications and Remarks
1	230	L	1925	326			50	50	Prepared from Sn containing < 0.05% impurities; supplied by Baker; specimen 10 cm long, 1.9 cm dia.; electrical conductivity at 22 C, σ (22 C) 9.98 x 10⁴ ohm⁻¹ cm⁻¹.
2	230	L	1925	326			60	40	Similar to the above specimen except σ (22 C) 9.11 x 10⁴ ohm⁻¹ cm⁻¹.
3	230	L	1925	326			70	30	Similar to the above specimen except σ (22 C) 9.17 x 10⁴ ohm⁻¹ cm⁻¹.
4	230	L	1925	326			80	20	Similar to the above specimen except σ (22 C) 8.39 x 10⁴ ohm⁻¹ cm⁻¹.
5	230	L	1925	326			90	10	Similar to the above specimen except σ (22 C) 7.73 x 10⁴ ohm⁻¹ cm⁻¹.
6	230	L	1925	326			95	5	Similar to the above specimen except σ (22 C) 7.34 x 10⁴ ohm⁻¹ cm⁻¹.
7	514	L	1962	313-603			95.1	4.9	Prepared from 99.94 pure Sn; in liquid state above 225 C.
8	514	L	1962	353-593			49.83	49.80	Prepared from 99.94 pure Sn; in liquid state above 215 C.

DATA TABLE NO. 212 THERMAL CONDUCTIVITY OF [TIN + CADMIUM] ALLOYS

(Sn + Cd ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
326	0.699
CURVE 2	
326	0.653
CURVE 3	
326	0.644
CURVE 4	
326	0.594
CURVE 5	
326	0.557
CURVE 6	
326	0.536
CURVE 7	
313.2	0.515
333.2	0.502
363.2	0.506
393.2	0.527
403.2	0.544
408.2	0.565
433.2	0.586
438.2	0.582
448.2	0.598
463.2	0.594
478.2	0.490
498.2	0.305
523.2	0.314
553.2	0.335
603.2	0.364

T	k
CURVE 8	
353.2	0.669
388.2	0.690
408.2	0.711
433.2	0.732
488.2	0.297
503.2	0.314
528.2	0.343
548.2	0.360
568.2	0.377
593.2	0.418

* Not shown on plot

SPECIFICATION TABLE NO. 213 THERMAL CONDUCTIVITY OF [TIN + COPPER] ALLOYS

(Sn + Cu ≥ 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Cu	Composition (continued), Specifications and Remarks
1	459	R	1905	287		$Sn_{90}Cu_{10}$	90.25	9.75	Cast and turned.
2	459	R	1905	287		$Sn_{75}Cu_{25}$	75.05	24.95	Cast and turned.

DATA TABLE NO. 213 THERMAL CONDUCTIVITY OF [TIN + COPPER] ALLOYS

(Sn + Cu ≥ 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
286.7	0.548
CURVE 2	
286.7	0.584

No graphical presentation

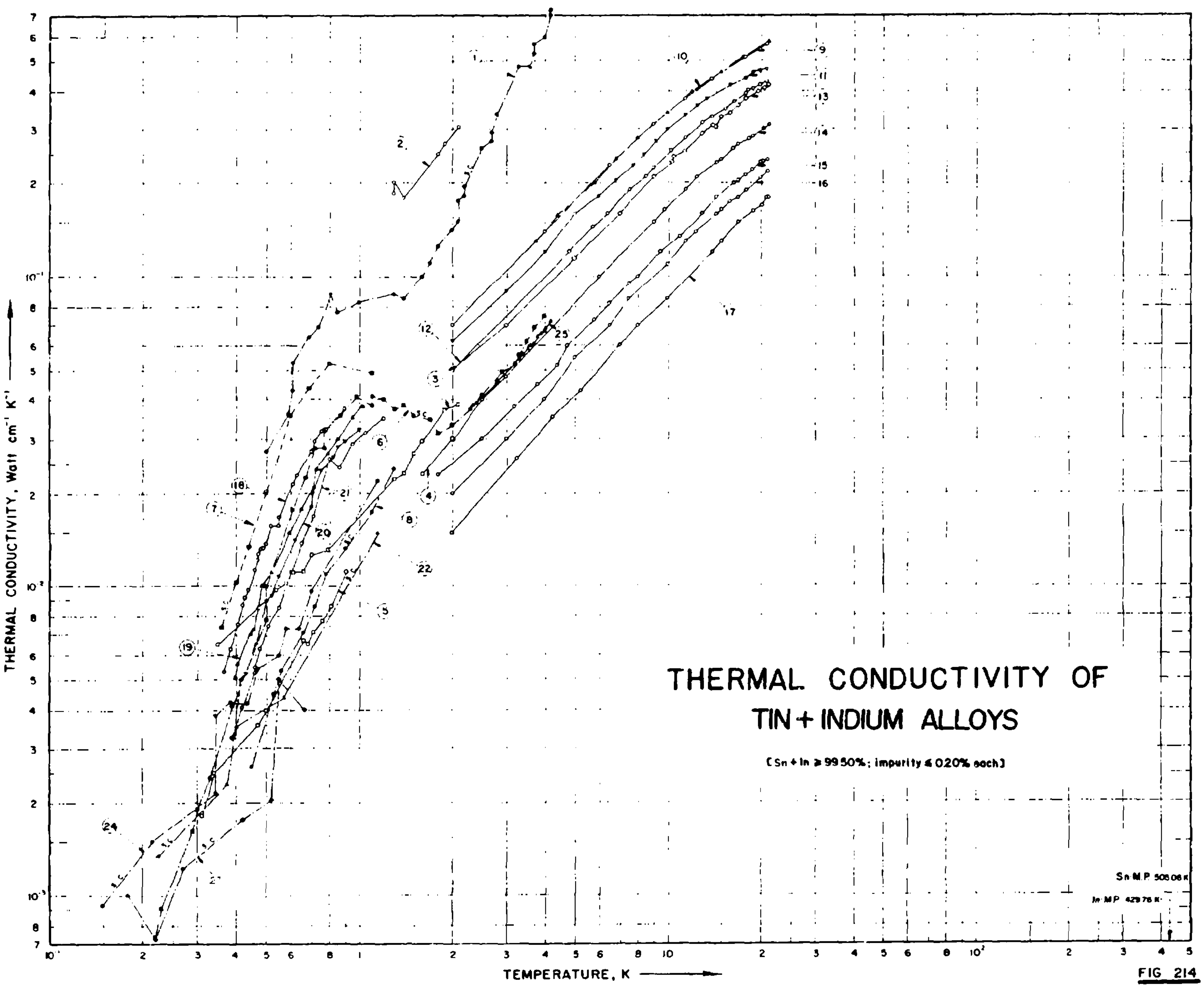

THERMAL CONDUCTIVITY OF
TIN + INDIUM ALLOYS
[Sn + In ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Sn M.P. 505.06 K
In M.P. 429.78 K

FIG. 214

SPECIFICATION TABLE NO. 214 THERMAL CONDUCTIVITY OF [TIN + INDIUM] ALLOYS

(Sn + In > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 214]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	In	Composition (continued), Specifications and Remarks
1	452	L	1955	0.5-4.2	2-4	Sn 7 JM 4600 + In	99.65	0.35	Cast; single crystal with tetragonal axis 82° to rod axis; in superconducting state.
2	452	L	1955	1.3-2.1	2-4	Sn 7 JM 4600 + In	99.65	0.35	The above specimen measured in a longitudinal field of 400 gauss; in normal state.
3	452	L	1955	0.35-2.1	2-4	Sn 8 JM 4600 + In	96.9	3.1	Cast; single crystal with tetragonal axis 73° to rod axis; measured in a longitudinal field of 450 gauss; in normal state.
4	452	L	1955	1.6-2.0	2-4	Sn 8 JM 4600 + In	96.9	3.1	The above specimen measured after switching off the magnetic field.
5	452	L	1955	0.31-0.91	2-4	Sn 8 JM 4600 + In	96.9	3.1	The above specimen measured in a longitudinal field of 300 gauss; in normal state.
6	452	L	1955	0.22-4.0	2-4	Sn 8 JM 4600 + In	96.9	3.1	The above specimen in superconducting state.
7	452	L	1955	0.36-1.1	2-4	Sn 8 JM 4600 + In	96.9	3.1	The above specimen annealed at 210 C for 14 days; in superconducting state.
8	452	L	1955	0.45-1.3	2-4	Sn 9 JM 4600 + In	96.9	3.1	Polycrystal; grain size about 0.3 mm; cast, strained and annealed for 17 days; in superconducting state.
9	453	L	1958	2.0-21	< 1.0	Sn 2	97.98	2.02	Prepared from spectroscopically pure Sn and 99.9 pure In; single crystal; angle between tetragonal axis and specimen axis (orientation) = 90°.
10	453	L	1958	3.8-21	< 1.0	Sn 2'	97.98	2.02	Similar to the above specimen except orientation = 77°; in normal state.
11	453	L	1958	2.0-21	< 1.0	Sn 2.1	97.89	2.11	Similar to the above specimen except orientation = 70°; in normal state.
12	453	L	1958	2.0-21	< 1.0	Sn 2.5	97.55	2.45	Similar to the above specimen except orientation = 85°; in normal state.
13	453	L	1958	2.0-21	< 1.0	Sn 2.8	97.16	2.84	Prepared from spectroscopically pure Sn and 99.9 pure In; single crystal with about 5% of volume being inclusions of foreign orientation; orientation = 78°; in normal state.
14	453	L	1958	2.0-22	< 1.0	Sn 4	96.04	3.96	Prepared from spectroscopically pure Sn and 99.9 pure In; coarse polycrystal with grain size about 2-3 mm; in normal state.
15	453	L	1958	1.8-21	< 1.0	Sn 5	95.03	4.97	Similar to the above specimen.

SPECIFICATION TABLE NO. 214 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	In	Composition (continued), Specifications and Remarks
16	453	L	1958	2.0-21	< 1.0	Sn 5.7	94.35	5.65	Similar to the above specimen.
17	453	L	1958	2.0-21	< 1.0	Sn 8.2	91.8	8.2	Prepared from spectroscopically pure Sn and 99.9 pure In; fine grained polycrystal; in normal state.
18	454	L	1958	0.37-0.90	2.0	B 6	97.0	3.0	Specimen 1.48 mm in diameter; cast; homogenized by annealing in vacuo for 2 weeks at 320 C; electro polished; angle between tetrad axis and specimen axis = 80°; surface roughness 0.09 μ.
19	454	L	1958	0.40-1.0	2.0	B 4	97.0	3.0	Similar to the above specimen except the diameter 0.875 mm and surface roughness 0.15 μ.
20	454	L	1958	0.39-1.0	2.0	B 1	97.0	3.0	Similar to the above specimen except the diameter 1.48 mm, surface roughness 1.0 μ, etched.
21	454	L	1958	0.39-1.2	2.0	B 5	97.0	3.0	Similar to the above specimen except the diameter, 0.875 mm.
22	455	L	1953	0.23-1.2	10-25	Sn IX	97	3	Specimen 2.8 mm in diameter; polycrystal; cast in tube; crystals size of the order of the diameter; in superconducting state.
23	455	L	1953	0.18-0.67	10-25	Sn X	97	3	Similar to the above specimen except the size of crystals being a fraction of the diameter.
24	455	L	1953	0.15-1.2	10-25	Sn IV	99.7	0.3	Similar to the above specimen except crystals size of the order of the diameter.
25	456	L	1958	2.3-4.2	2	3	97.0	3.0	Specimen annealed for several months; measured in a longitudinal magnetic field of about 560 gauss; in normal state.

DATA TABLE NO. 214 THERMAL CONDUCTIVITY OF [TIN + INDIUM] ALLOYS

(Sn + In > 99.50%; Impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

CURVE 1

T	k
0.50	0.0274
0.59	0.0357
0.61	0.0430
0.61	0.0530
0.69	0.064
0.74	0.069
0.81	0.086
0.85	0.077
1.0	0.083
1.3	0.088
1.4	0.085
1.6	0.100
1.7	0.111
1.8	0.125
2.0	0.142
2.1	0.151
2.1	0.176
2.2	0.182
2.2	0.195
2.5	0.263
2.7	0.275
2.7	0.292
2.8	0.335
3.3	0.48
3.5	0.48
3.7	0.53
3.7	0.57
4.0	0.60
4.2	0.70
4.2	0.73

CURVE 2

T	k
1.3	0.186
1.3	0.201
1.4	0.180
1.8	0.250
1.9	0.270
2.1	0.305

CURVE 3

T	k
0.35	0.0065
0.54	0.0097
0.58	0.0101
0.61	0.0111
0.66	0.0112
0.70	0.0127
0.79	0.0131
1.3	0.0222
1.4	0.0232
1.5	0.0270
1.6	0.0295
1.9	0.037
2.1	0.0385

CURVE 4

T	k
1.6	0.0231
2.0	0.030

CURVE 5

T	k
0.31	0.00181
0.34	0.0025
0.47	0.00359
0.50	0.0040
0.66	0.0067
0.68	0.0065
0.71	0.0071
0.76	0.0077
0.81	0.0086
0.91	0.0112

CURVE 6

T	k
0.22	0.00074
0.23	0.00091
0.29	0.00163
0.30	0.00192
0.33	0.00243
0.39	0.00415
0.50	0.0078
0.50	0.0100
0.61	0.0178
0.67	0.0225
0.72	0.028
0.77	0.028
0.77	0.032
0.87	0.0355
0.98	0.041
1.1	0.0381
1.1	0.041
1.2	0.040
1.3	0.037
1.4	0.0381
1.5	0.0355
1.7	0.0345
1.8	0.0311
2.0	0.033
2.3	0.037
2.5	0.0415
2.9	0.0495
3.2	0.0525
3.3	0.056
3.5	0.062
3.7	0.069
4.0	0.075

CURVE 7

T	k
0.36	0.00735
0.40	0.0102
0.44	0.0135
0.50	0.0202
0.54	0.025
0.60	0.0355
0.69	0.0435
0.80	0.0525
1.10	0.049

CURVE 8

T	k
0.45	0.00263
0.53	0.0045
0.56	0.00535
0.66	0.0071
0.72	0.0086
0.78	0.0110
0.90	0.0133
1.1	0.0175
1.3	0.0242

CURVE 9

T	k
2.0	0.070
4.0	0.140
6.5	0.230
9.0	0.310
11.5	0.380
14.0	0.440
18.0	0.515
21.0	0.570

CURVE 10

T	k
3.75	0.130
4.40	0.158
5.70	0.200
6.80	0.240
8.00	0.280
10.00	0.340
12.00	0.400
15.00	0.465
17.60	0.515
21.10	0.580

CURVE 11

T	k
2.00	0.062
3.00	0.090
4.00	0.120
5.00	0.160
6.00	0.182
6.80	0.205
7.80	0.230
8.40	0.250
9.20	0.275
10.00	0.300
11.50	0.335
12.50	0.360
13.50	0.380
16.00	0.420
18.00	0.440
19.00	0.460
20.00	0.465
21.00	0.470

CURVE 12

T	k
2.00	0.050
4.80	0.120
5.75	0.145
6.40	0.160
7.50	0.190
8.50	0.210
9.00	0.225
10.30	0.255
11.50	0.280
13.00	0.315
14.00	0.330
15.50	0.350
16.50	0.370
18.00	0.395
18.20	0.405
19.00	0.410
20.00	0.420
21.00	0.430

CURVE 13

T	k
2.00	0.050
3.00	0.070
5.00	0.115
7.00	0.160
9.00	0.210
10.40	0.235
10.50	0.245
11.40	0.255
13.00	0.290
14.00	0.310
14.40	0.305
15.00	0.330
16.00	0.340
17.00	0.360
18.00	0.380
19.70	0.400
20.70	0.410
21.20	0.420

CURVE 14

T	k
2.00	0.030
2.50	0.040
5.00	0.048
6.00	0.100
9.00	0.150
9.80	0.165
11.50	0.190
12.50	0.210
14.50	0.23[illegible]
15.00	0.240
16.40	0.260
17.00	0.268
18.50	0.280
19.00	0.285
19.40	0.290
20.50	0.300
21.50	0.310

CURVE 15

T	k
1.80	0.023
2.50	0.030
3.20	0.038
3.80	0.045
4.40	0.052
4.75	0.060
5.80	0.073
6.50	0.082
7.50	0.095
8.00	0.100
9.50	0.120
11.00	0.135
13.00	0.160
14.50	0.180
16.50	0.200
17.00	0.205
18.00	0.214
18.80	0.222
20.00	0.235
20.50	0.236
21.20	0.240

CURVE 16

T	k
2.00	0.020
3.00	0.030
4.00	[illegible]
5.00	[illegible]
6.50	[illegible]
7.50	[illegible]
10.00	0.110
11.50	0.130
12.40	0.140
14.50	0.160
15.00	0.165
16.00	0.175
17.00	0.180
18.00	0.190
20.00	0.210
21.20	[illegible]

CURVE 17

T	k
2.00	0.015
3.25	[illegible]
4.25	[illegible]
5.25	[illegible]
7.00	[illegible]
8.00	0.070
10.00	[illegible]
11.00	0.120
15.00	0.130
17.00	0.150
19.00	0.16[illegible]
20.40	0.170
21.00	0.180
21.20	0.190

CURVE 18

T	k
0.365	0.00528
0.385	0.00627
0.405	0.0075
0.42	0.0087
0.427	0.00915
0.44	0.0972
0.46	0.0113
0.472	0.0122
0.474	0.0128
0.48	0.0132
0.487	0.0134
0.496	0.0138
0.52	0.0137
0.548	0.0157
0.548	0.0166
0.61	0.0216
0.628	0.0230
0.65	0.0238
0.698	0.0275
0.718	0.0296
0.735	0.0318
0.78	0.0323
0.90	0.0372

CURVE 19

T	k
0.398	0.0051
0.402	0.0056
0.445	0.007
0.455	0.0072[illegible]
0.468	0.0065
0.485	0.01
0.520	0.0111
0.595	0.015
0.648	0.0178
0.71	0.0219
0.725	0.024
0.79	0.027
0.85	0.030
0.95	0.0351
1.015	0.038
1.03	0.038

CURVE 20

T	k
0.392	0.00323
0.415	0.005
0.430	0.00522
0.465	0.0065
0.50	0.00898
0.517	0.0093
0.548	0.0107
0.618	0.0142
0.699	0.0181

DATA TABLE NO. 211 (continued)

T	k	T	k
CURVE 20(cont.)		CURVE 24	
0.705	0.02	0.148	0.000930
0.75	0.0238	0.215	0.00150
0.822	0.0263	0.345	0.00385
0.852	0.0284	0.345	0.00215
0.90	0.0295	0.385	0.00425
0.998	0.0322	0.435	0.00420
		0.470	0.00540
CURVE 21		0.550	0.00600
		0.580	0.00730
0.39	0.00325	0.640	0.00730
0.42	0.0041	0.700	0.00960
0.46	0.00525	1.150	0.0220
0.46	0.00548		
0.45	0.00630	CURVE 25	
0.508	0.00745		
0.547	0.0085	2.34	0.0381
0.602	0.0111	2.40	0.0368
0.652	0.0135	2.80	0.0452
0.71	0.0163	2.83	0.0466
0.80	0.0260	3.29	0.0544
0.86	0.0244	3.40	0.0561
0.948	0.0290	3.54	0.0586
1.05	0.0315	3.60	0.0600
1.20	0.035	3.69	0.0607
		3.80	0.0642
CURVE 22		3.89	0.0657
		3.97	0.0667
0.225	0.00135	4.03	0.0681
0.375	0.00230	4.23	0.0726
0.400	0.00335		
0.570	0.00440		
1.150	0.0150		
CURVE 23			
0.150	0.00100		
0.220	0.00073		
0.270	0.00123		
0.320	0.00176		
0.520	0.00205		
0.570	0.00300		
0.670	0.00400		

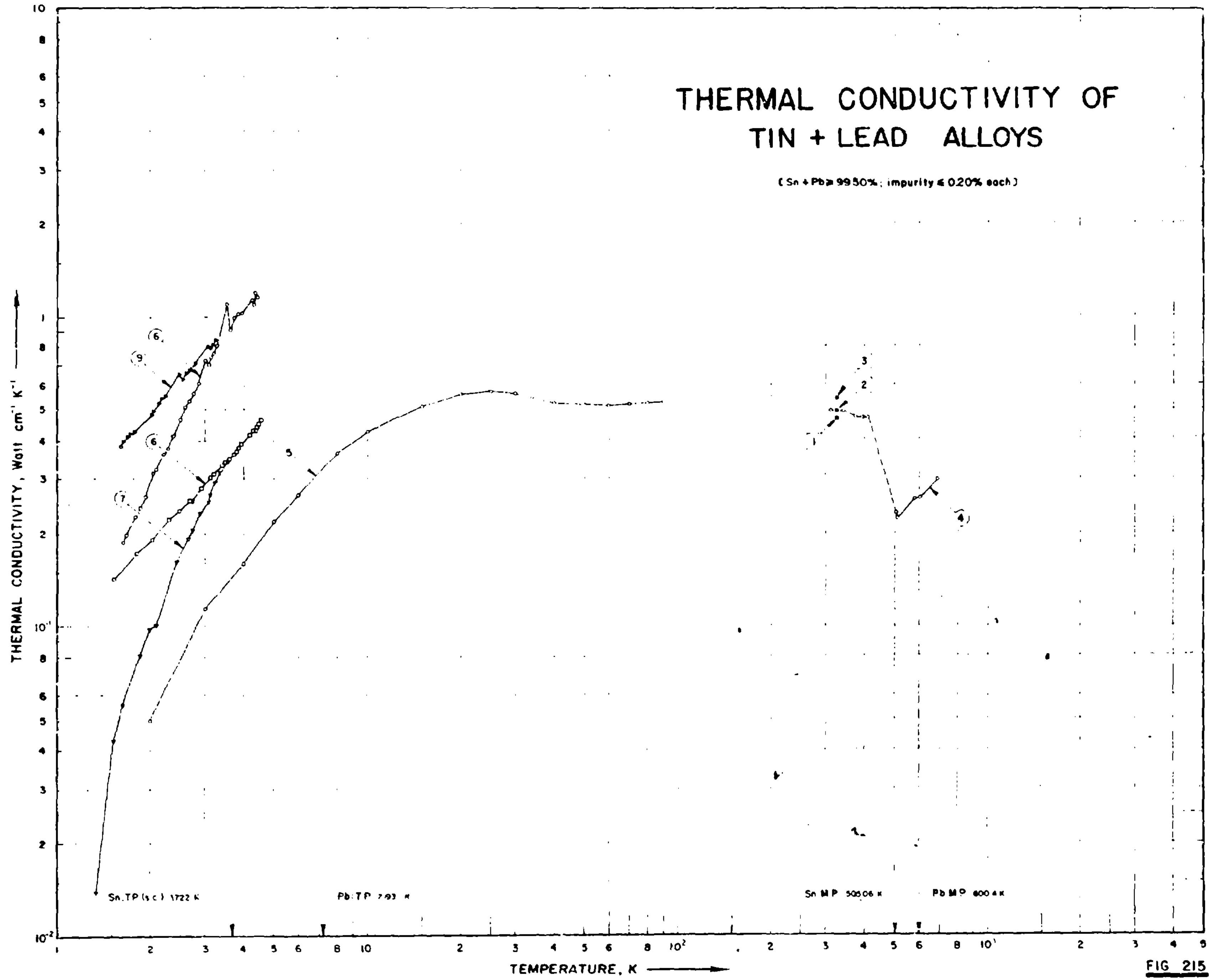

THERMAL CONDUCTIVITY OF
TIN + LEAD ALLOYS
(Sn + Pb ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Sn.TP (s.c.) 1722 K
Pb.TP 7.193 K
Sn M.P. 505.06 K
Pb M.P. 600.4 K
1
2
3
4
5
6
7
9

FIG. 215

SPECIFICATION TABLE NO. 215 THERMAL CONDUCTIVITY OF [TIN + LEAD] ALLOYS

(Sn + Pb ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 215]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Pb	Composition (continued), Specifications and Remarks
1	230	L	1925	327.2			50	50	Approx. composition: 0.03 total impurity in each metal; specimen 1.9 cm in dia and 10 cm long; supplied by Baker; electrical conductivity 6.47×10^4 ohm^{-1} cm^{-1} at 22 C.
2	230	L	1925	327.2			60	40	Similar to the above specimen except electrical conductivity 6.92×10^4 $ohm^{-1} cm^{-1}$ at 22 C.
3	230	L	1925	327.2			80	20	Similar to the above specimen except electrical conductivity 7.62×10^4 $ohm^{-1} cm^{-1}$ at 22 C.
4	19	L	1923	313-693			62	38	Specimen 1.5 cm in dia and 12 cm long; melting point 180 C.
5	229	L	1955	2.0-90		Soft solder	60	40	No other details reported.
6	837	L	1967	1.5-4.6	1	Pb 3	98.30	1.70	Prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Pb, extruding into 1.5 mm dia wire, annealed at ~200 C for several days; electrical resistivity 0.00478 and 13.55 μohm cm at 4.2 and 273 K, respectively, T_c 3.752 K; normal-state data were taken at temperatures below T_c with a longitudinal magnetic field applied to the sample.
7	837	L	1967	1.3-3.6	1	Pb 3	98.30	1.70	Same as the above specimen, except the magnetic field was removed so the superconducting-state data were taken.
8	836	L	1958	1.6-4.4	4-5	7	99.54	0.46	Prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Pb, casting into 1 mm dia x 12 cm long wire with pyrex capillary; electrical resistivity 0.112 μohm cm; a magnetic field was applied when taking normal-state data at temperatures below T_c.
9	836	L	1958	1.6-3.3	4-5	7	99.54	0.46	Same as the above specimen except the magnetic field was removed so the superconducting-state data were taken.

DATA TABLE NO. 215 THERMAL CONDUCTIVITY OF (TIN + LEAD) ALLOYS

($Sn + Pb \geq 99.50\%$; impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
327.2	0.464
CURVE 2	
327.2	0.490
CURVE 3	
327.2	0.544
CURVE 4	
313.2	0.493
343.2	0.492
375.2	0.471
396.2	0.469
397.2	0.468
412.2	0.467
509.2	0.231
512.2	0.223
583.2	0.255
609.2	0.257
693.2	0.297
CURVE 5	
2	0.050
3	0.115
4	0.160
5	0.220
6	0.265
8	0.365
10	0.425
15	0.510
20	0.560
25	0.575
30	0.565
40	0.525
50	0.520
60	0.515
70	0.520
80	0.525
90	0.530
CURVE 6	
1.537	0.142
1.815	0.172
2.030	0.191
2.299	0.222
2.488	0.237
2.677	0.255
2.716	0.255
2.923	0.278
3.116	0.300
3.201	0.308
3.439	0.331
3.491	0.339
3.601	0.347
3.728	0.360
3.795	0.367
3.868	0.379
3.942	0.389
3.988	0.393*
4.193	0.415
4.264	0.415*
4.292	0.426
4.337	0.423*
4.372	0.427
4.419	0.437
4.482	0.449
4.537	0.454*
4.578	0.462
4.619	0.469*
4.620	0.457*
CURVE 7	
1.346	0.014
1.526	0.043
1.636	0.056
1.856	0.081
1.997	0.098
2.093	0.101
2.445	0.162
2.657	0.192
2.745	0.205
2.894	0.233
3.078	0.252
CURVE 7 (cont.)	
3.124	0.265
3.242	0.289
3.367	0.312
3.518	0.340*
3.565	0.340
CURVE 8	
1.635	0.188
1.683	0.198
1.794	0.227
1.851	0.242
1.934	0.263
2.043	0.311
2.094	0.320
2.211	0.360
2.285	0.378
2.373	0.415
2.501	0.464
2.593	0.507
2.677	0.532
2.762	0.567
2.872	0.613
3.016	0.719
3.080	0.698
3.137	0.736
3.203	0.757
3.283	0.800
3.545	1.009
3.633	0.908
3.729	0.992
3.842	1.016
3.967	1.039
4.266	1.130
4.322	1.098
4.358	1.191
4.406	1.176*
4.440	1.151
CURVE 9	
1.604	0.383
1.630	0.397
CURVE 9 (cont.)	
1.690	0.413
1.723	0.420
1.770	0.425
2.021	0.479
2.050	0.494
2.141	0.522
2.188	0.544
2.248	0.554
2.470	0.652
2.547	0.632
2.616	0.658
2.682	0.672
2.778	0.702
3.008	0.726*
3.062	0.800
3.127	0.791
3.186	0.807
3.265	0.844

* Not shown on plot

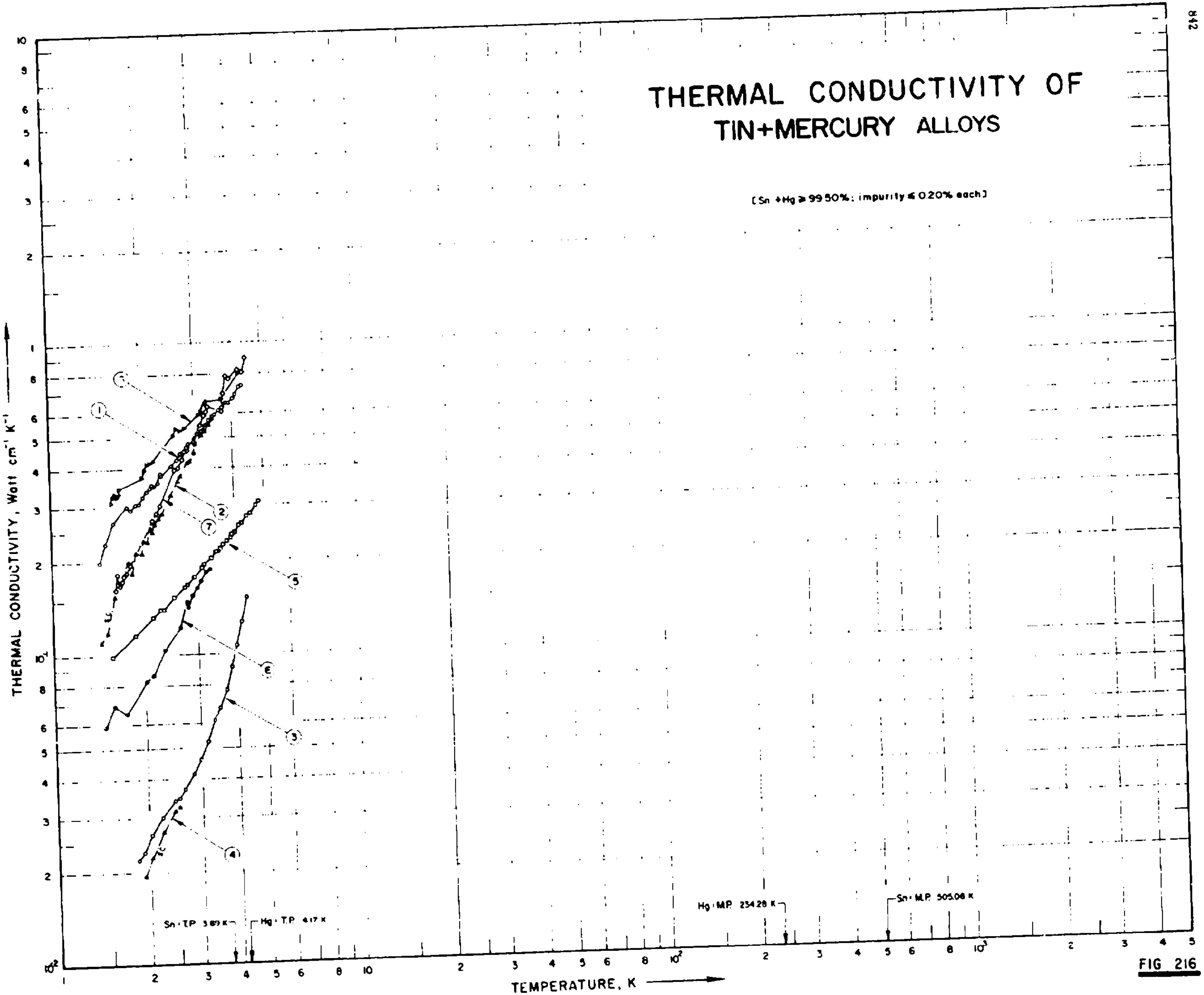

THERMAL CONDUCTIVITY OF
TIN+MERCURY ALLOYS
[Sn + Hg ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Sn: T.P. 3.69 K
Hg: T.P. 4.17 K
Hg: M.P. 234.28 K
Sn: M.P. 505.08 K

FIG 216

SPECIFICATION TABLE NO. 216 THERMAL CONDUCTIVITY OF [TIN + MERCURY] ALLOYS

(Sn + Hg $>$ 99.50%; impurity $<$ 0.20% each)

[For Data Reported in Figure and Table No. 216]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Hg	Composition (continued), Specifications and Remarks
1	74	L	1950	1.4-4.3	3.0	Sn 6	99.67	0.33	Homogeneous solid solution with few large crystals supplied by Johnson-Matthey (J.2356); in normal state, measured in a longitudinal magnetic field.
2	74	L	1950	1.4-3.5	3.0	Sn 6	99.67	0.33	The above specimen in superconducting state.
3	74	L	1950	1.8-4.3	3.0	Sn 9	95.9	4.1	Specimen in two phase state with few large crystals; supplied by Johnson-Matthey (J. 2356); in normal state; measured in a longitudinal magnetic field.
4	74	L	1950	1.9-2.5	3.0	Sn 9	95.9	4.1	The above specimen in superconducting state.
5	837	L	1967	1.6-4.8	1	Hg 3	98.15	1.85	Prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Hg, extruding into 1.5 mm dia wire, annealed at ~200 C for several days; electrical resistivity 0.475 and 13.35 μohm cm at 4.2 and 273 K, respectively, T_c 3.646 K; normal-state data were taken at temperatures below T_c with a longitudinal magnetic field applied at the sample.
6	837	L	1967	1.5-3.5	1	Hg 3	98.15	1.85	Same as the above specimen, except the magnetic field was removed so the superconducting-state data were taken.
7	836	L	1958	1.6-4.4	4-5	1	99.47	0.53	Prepared by vacuum-melting appropriate amounts of Johnson-Matthey 99.999 pure Sn and Hg, casting into 1 mm dia x 12 cm long wire with pyrex capillary; electrical resistivity 0.77 μohm cm; a magnetic field was applied when taking normal-state data at temperatures below T_c.
8	836	L	1958	1.6-4.3	4-5	1	99.47	0.53	Same as the above specimen except the magnetic field was removed so the superconducting-state data were taken.

DATA TABLE NO. 216 THERMAL CONDUCTIVITY OF [TIN + MERCURY] ALLOYS

($Sn + Hg \geq 99.50\%$; impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
1.44	0.198
1.51	0.229
1.61	0.267
1.79	0.300
1.84	0.291
1.91	0.305
1.97	0.306
2.02	0.322
2.08	0.335
2.13	0.343
2.16	0.352
2.20	0.348
2.27	0.359
2.32	0.385
2.33	0.376
2.51	0.403
2.63	0.424
2.70	0.445
2.83	0.463
2.88	0.478
3.00	0.463
3.08	0.516
3.18	0.525
3.27	0.550
3.37	0.560
3.46	0.588
3.54	0.593
3.65	0.612
3.73	0.622
3.84	0.648
3.92	0.646
4.03	0.664
4.12	0.682
4.24	0.721
4.32	0.730
CURVE 2	
1.44	0.110
1.51	0.118
1.60	0.155
1.79	0.199
CURVE 2 (cont.)	
1.84	0.183
1.90	0.213
1.98	0.212
2.01	0.233
2.08	0.231
2.12	0.255
2.16	0.249
2.20	0.264
2.27	0.275
2.34	0.285
2.50	0.327
2.63	0.363
2.69	0.376
2.83	0.415
2.88	0.420
3.00	0.446
3.08	0.475
3.18	0.508
3.27	0.528
3.37	0.550
3.45	0.571
CURVE 3	
1.83	0.0220
1.91	0.0235
2.03	0.0265
2.21	0.0300
2.43	0.0340
2.52	0.0345
2.63	0.0370
2.82	0.0415
2.98	0.0460
3.16	0.0525
3.34	0.0615
3.46	0.0725
3.67	0.0770
3.82	0.0910
3.98	0.107
4.15	0.127
4.[illegible]	0.152
CURVE 4	
1.92	0.0195
2.04	0.0225
2.21	0.0270
2.44	0.0315
2.51	0.0325
CURVE 5	
1.56	0.099
1.86	0.116
2.15	0.132
2.26	0.140
2.32	0.140
2.51	0.153
2.74	0.165
2.77	0.168
2.94	0.178
3.11	0.190
3.17	0.195
3.35	0.204
3.43	0.214
3.52	0.215
3.54	0.218*
3.58	0.219
3.63	0.222*
3.66	0.226
3.77	0.231
3.83	0.234*
3.87	0.238
3.94	0.244
4.00	0.248
4.15	0.259
4.24	0.263
4.28	0.266*
4.39	0.276
4.52	0.281
4.55	0.289*
4.71	0.298
4.75	0.299*
4.83	0.307
CURVE 6	
1.46	0.059
1.58	0.069
1.72	0.065
2.02	0.083
2.14	0.086
2.33	0.104
2.36	0.105*
2.61	0.122
2.62	0.128*
2.77	0.148
2.79	0.142
2.89	0.155
3.00	0.164
3.06	0.172
3.21	0.184
3.21	0.186*
3.31	0.187
3.54	0.215*
CURVE 7	
1.62	0.163
1.65	0.182
1.67	0.167
1.70	0.174
1.72	0.180
1.76	0.184
1.81	0.195
1.84	0.192*
2.05	0.234*
2.11	0.253*
2.17	0.271
2.24	0.285
2.30	0.301
2.58	0.395
2.66	0.400
2.75	0.425
2.79	0.450
2.85	0.454
3.11	0.512*
3.16	0.548
3.25	0.590
CURVE 7 (cont.)	
3.30	0.609
3.35	0.628
3.71	0.609
3.78	0.690
3.86	0.789
3.94	0.770
4.23	0.821
4.35	0.805
4.45	0.894
CURVE 8	
1.58	0.309
1.61	0.324
1.65	0.331
1.67	0.324
1.69	0.331
1.69	0.344
1.72	0.344*
2.02	0.372
2.06	0.396
2.10	0.414
2.15	0.415
2.20	0.421
2.57	0.507
2.63	0.535
2.70	0.527
2.75	0.522*
2.79	0.538
3.11	0.592
3.17	0.608
3.25	0.654*
3.28	0.645
3.32	0.654
3.72	0.669
4.26	0.800

* Not shown on plot

SPECIFICATION TABLE NO. 217 THERMAL CONDUCTIVITY OF (TIN + SILVER) ALLOYS

($Sn + Ag > 99.50\%$; impurity $\leq 0.20\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Ag	Composition (continued), Specifications and Remarks
1	230	L	1925	333.2			60.0	40.0	Impurities < 0.03.
2	230	L	1925	333.2			70.0	30.0	Impurities < 0.03.
3	230	L	1925	333.2			80.0	20.0	Impurities < 0.03.
4	230	L	1925	333.2			90.0	10.0	Impurities < 0.03.

DATA TABLE NO. 217 THERMAL CONDUCTIVITY OF (TIN + SILVER) ALLOYS

($Sn + Ag > 99.50\%$; impurity $< 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
333.2	0.611
CURVE 2*	
333.2	0.611
CURVE 3*	
333.2	0.611
CURVE 4*	
333.2	0.603

* No graphical presentation

SPECIFICATION TABLE NO. 218 THERMAL CONDUCTIVITY OF [TIN + THALLIUM] ALLOYS

(Sn + Tl > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Tl	Composition (continued), Specifications and Remarks
1	230	L	1925	336.2			53.8	46.2	Impurities < 0.03.
2	230	L	1925	336.2			60.0	40.0	Impurities < 0.03.
3	230	L	1925	336.2			70.0	30.0	Impurities < 0.03.
4	230	L	1925	336.2			80.0	20.0	Impurities < 0.03.
5	230	L	1925	336.2			90.0	10.0	Impurities < 0.03.

DATA TABLE NO. 218 THERMAL CONDUCTIVITY OF [TIN + THALLIUM] ALLOYS

(Sn + Tl > 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
336.2	0.385
CURVE 2*	
336.2	0.418
CURVE 3*	
336.2	0.435
CURVE 4*	
336.2	0.485
CURVE 5*	
336.2	0.557

* No graphical presentation

SPECIFICATION TABLE NO. 219 THERMAL CONDUCTIVITY OF [TIN + ZINC] ALLOYS

(Sn + Zn > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Zn	Composition (continued), Specifications and Remarks
1	19	L	1923	308-706			92.0	8.0	

DATA TABLE NO. 219 THERMAL CONDUCTIVITY OF [TIN + ZINC] ALLOYS

(Sn + Zn > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
308.2	0.596
337.2	0.615
364.2	0.617
388.2	0.626
421.2	0.630
488.2	0.238
616.2	0.306
706.2	0.367

* No graphical presentation

SPECIFICATION TABLE NO. 220 THERMAL CONDUCTIVITY OF (TITANIUM + ALUMINUM) ALLOYS

(Ti + Al > 99.50%; impurity ≤ 0.2 % each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ti	Al	Composition (continued), Specifications and Remarks
1	554		1954	317.4			92	8	
2	555	C	1956	403.2			93	7	Melted in a nonconsumable arc furnace.

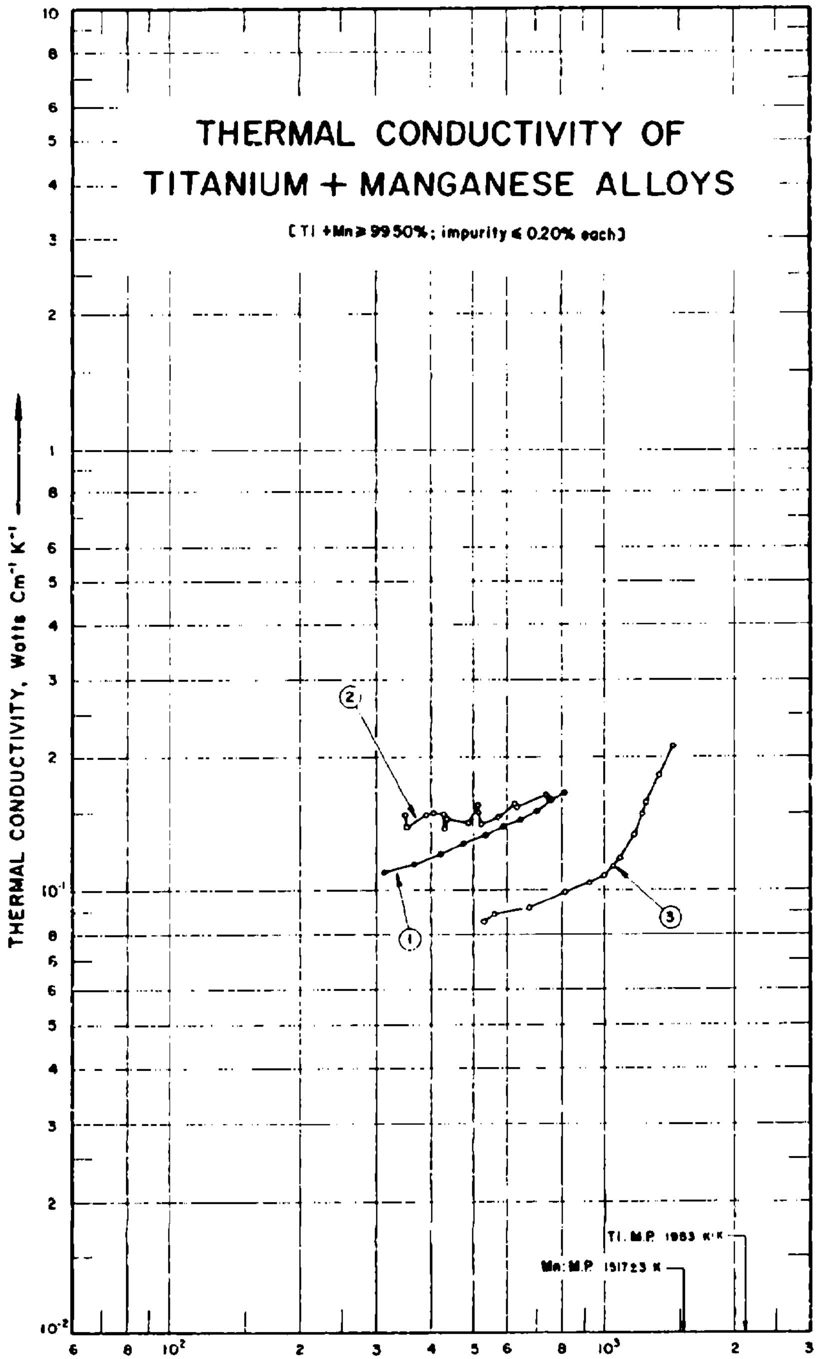
DATA TABLE NO. 220 THERMAL CONDUCTIVITY OF (TITANIUM + ALUMINUM) ALLOYS

(Ti + Al > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1*	
317.4	0.092
CURVE 2*	
403.2	0.0883

* No graphical presentation



THERMAL CONDUCTIVITY OF
TITANIUM + MANGANESE ALLOYS
[Ti + Mn ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Ti: M.P. 1953 K
Mn: M.P. 1517±3 K
1
2
3

FIG 221

SPECIFICATION TABLE NO. 221 THERMAL CONDUCTIVITY OF [TITANIUM + MANGANESE] ALLOYS

(Ti + Mn ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 221]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ti	Mn	Composition (continued), Specifications and Remarks
1	231	C	1958	311-811	< 5	Ti-8Mn	92	8	Nominal composition; formerly designated as RC-130 A. in a mill-annealed condition; measured in vacuum of ~2 x 10^{-5} mm Hg; electrical resistivity 93, 100, 108, 115, 122, 128, 135, 141, 146 and 151 μ ohm cm at 311, 366, 422, 477, 533, 589, 644, 700, 755 and 811 C respectively. Armco ingot iron used as comparative material.
2	340	L	1956	350-746	10	Ti-130A	93.21	6.5	0.20 Fe, 0.177 O, 0.0069 H, 0.05 C and 0.034 N; specimen 3/4 in. in diameter.
3	617	R	1961	534-1446	< 5	Ti-8Mn	91.81	7.9	0.03 C, 0.15 O and 0.01 W; specimen composed of 5 one in. diameter disks; density 4.59 g cm^{-3}.

DATA TABLE NO. 221 THERMAL CONDUCTIVITY OF [TITANIUM + MANGANESE] ALLOYS

(Ti + Mn ≥ 99.50%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		CURVE 3 (cont.)	
311	0.110	1222.1	0.149
366	0.115	1254.3	0.158
422	0.122	1345.4	0.183
477	0.128	1445.9	0.211
533	0.134		
589	0.140		
644	0.145		
700	0.152		
755	0.160		
811	0.167		
CURVE 2			
349.8	0.148		
351.6	0.140		
390.1	0.148		
405.4	0.150		
429.0	0.149		
429.0	0.138		
436.8	0.146		
487.9	0.143		
517.3	0.156		
517.9	0.151		
521.2	0.142		
574.0	0.146		
626.2	0.158		
631.8	0.1[illegible]5		
737.9	0.165		
745.7	0.162		
CURVE 3			
533.7	0.0855		
560.9	0.0888		
674.8	0.0917		
813.7	0.0990		
928.2	0.104		
999.8	0.108		
1050.9	0.114		
1086.5	0.118		
1167.1	0.134		

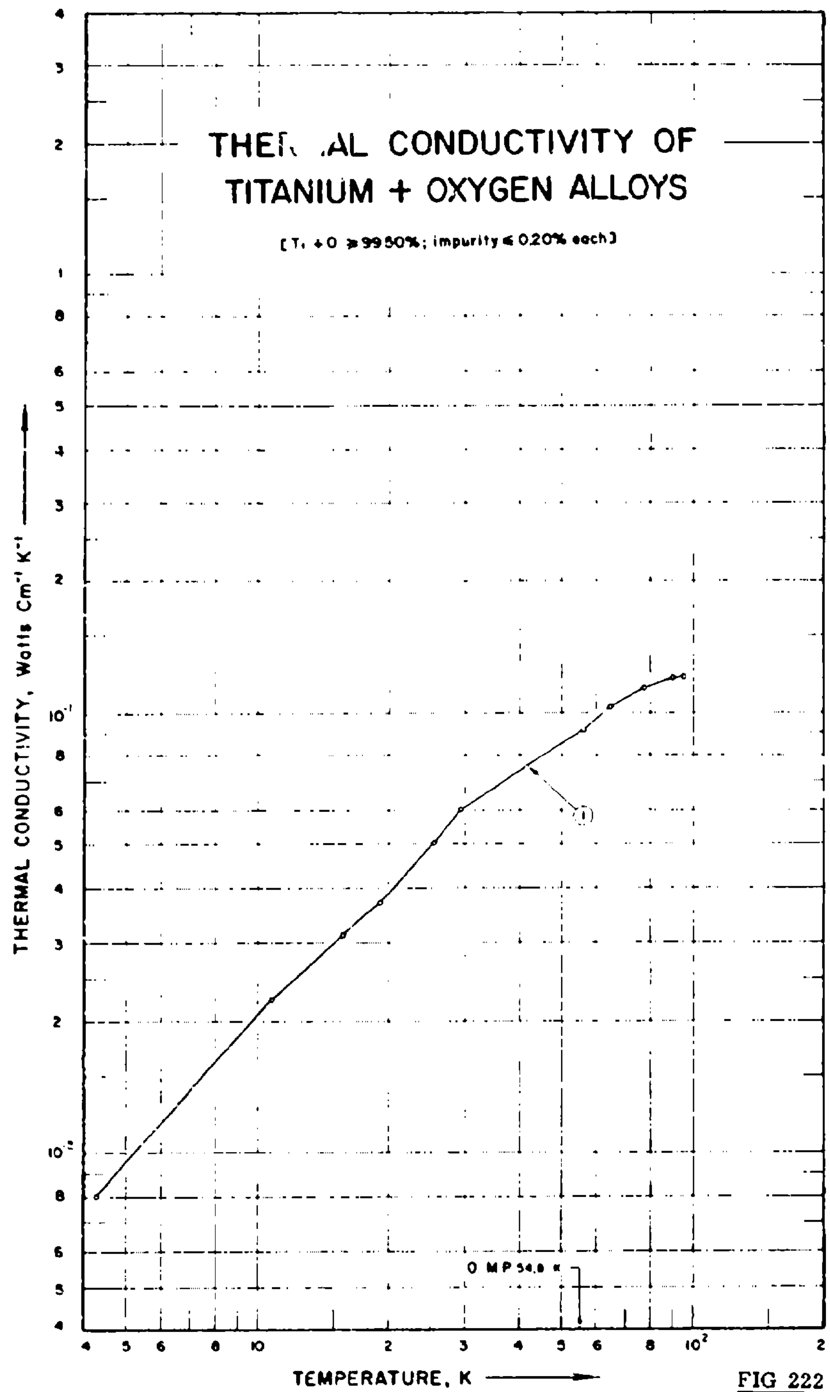

THER AL CONDUCTIVITY OF
TITANIUM + OXYGEN ALLOYS
[Ti + O ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
O MP 54.8 K
1

FIG 222

SPECIFICATION TABLE NO. 222 THERMAL CONDUCTIVITY OF [TITANIUM + OXYGEN] ALLOYS

(Ti + O > 99.50 %; impurity < 0.20 % each)

[For Data Reported in Figure and Table No. 222]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ti	O	Composition (continued), Specifications and Remarks
1	83	L	1956	4.3-96		JM 4233	98	1.63	0.024 Mg, 0.13 Si, 0.05 Fe, 0.081 Ni, 0.14 C; specimen 3 mm in dia, supplied by Messrs Johnson-Matthey and Co., Ltd; annealed at 950 C for 5 hrs *in vacuo*; ρ_0 = 23.6 μohm cm, electrical resistivity 70 μohm cm at 293 K.

DATA TABLE NO. 222 THERMAL CONDUCTIVITY OF [TITANIUM + OXYGEN] ALLOYS

(Ti + O > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
4.30	0.0080
10.81	0.0225
15.75	0.0314
19.25	0.0370
25.65	0.0504
29.50	0.0606
36.40	0.0920
65.90	0.104
77.50	0.114
90.50	0.120
95.25	0.121

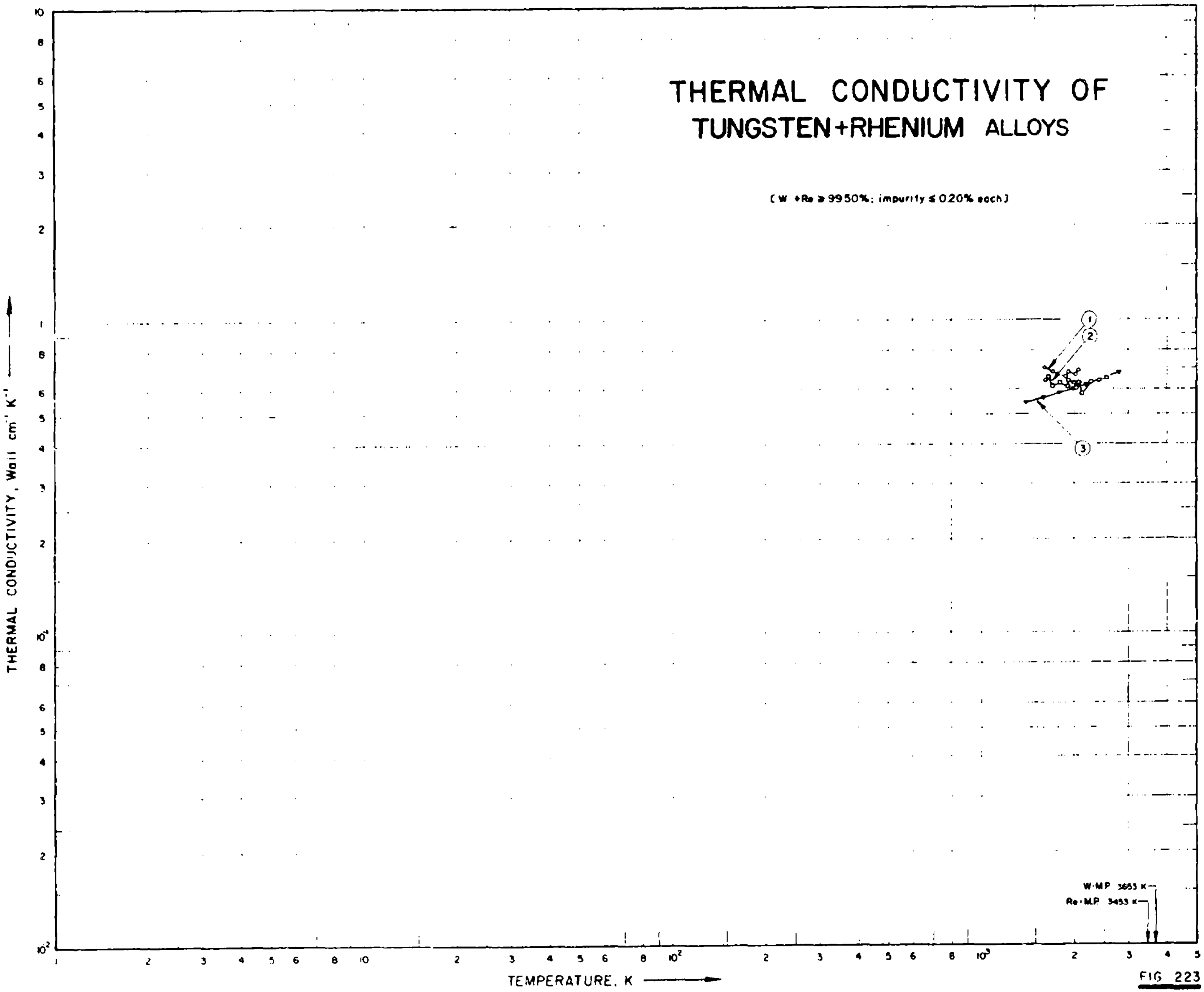

THERMAL CONDUCTIVITY OF
TUNGSTEN+RHENIUM ALLOYS
[W + Re ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
W: M.P. 3653 K
Re: M.P. 3453 K
1
2
3

FIG 223

SPECIFICATION TABLE NO. 223 THERMAL CONDUCTIVITY OF [TUNGSTEN + RHENIUM] ALLOYS

(W + Re ≥ 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 223]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) W	Re	Composition (continued), Specifications and Remarks
1	849	-	1966	1617-2074			Bal	25.04	0.0023 C, 0.0014 O, 0.001 Fe and 0.0005 N impurities; specimen 1.9195 cm in dia and 0.0766 cm long; avg grain size 0.216 mm dia; density 19.73 g cm^{-3}; thermal conductivity was derived from the temp distribution on the flat surface of the cylindrical disc specimen heated in high vacuum (10^{-5} mm Hg) by high frequency induction generating localized heating within 0.003 in. of the surface at current frequency of 500000 cps with heat lost only by radiation; the cylindrical surface being assumed isothermal, and the temp gradient along the radius was analytically correlated to the thermal conductivity.
2	849	-	1966	1625-2553			Bal	24.5	0.0025 C, 0.0022 O, and 0.0002 H; cut from the same bar as the above specimen; specimen 1.9208 cm in dia and 0.2103 cm long; avg grain size 0.041 mm dia; density 19.19 g cm^{-3}; measuring method same as that for the above specimen.
3	928,929		1966	1400-2800	±12	VR-27-VT	73.0	27.0	Specimen made from an ingot subjected to rotary swaging 7.8 mm in dia and 65 mm long; ground to a surface-finish class of 8; annealed in vacuum at 2200 K for 2 hrs before the measurements; melting point 3300 K; measured in vacuum with electronic heating at 1-5 x 10^{-5} mm Hg; electrical resistivity 60.4, 67.3, 73.9, 79.9, 85.7, 91.1, 96.8, 102.8 and 109.2 x 10^{-6} ohm cm at 1200, 1400, 1600, 1800, 2000, 2200, 2400, 2600, and 2800 K, respectively.

DATA TABLE NO. 223   THERMAL CONDUCTIVITY OF [TUNGSTEN + RHENIUM] ALLOYS

[W + Re > 99.50%; impurity < 0.20%]

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
1616.5	0.702
1710	0.682
1887	0.660
1928	0.680
2034	0.668
2074	0.697
CURVE 2	
1625	0.640
1669	0.657
1720	0.612
1802.5	0.627
1804.5	0.637*
1917	0.610
1925.5	0.638
2002.5	0.626
2043.5	0.603
2088	0.626
2097	0.623*
2128	0.580
2283	0.631
2415	0.639
2553	0.648
CURVE 3	
1400	0.544
1600	0.563
1800	0.582
2000	0.601
2200	0.620
2400	0.639*
2600	0.658*
2800	0.677

* Not shown on plot

SPECIFICATION TABLE NO. 224 THERMAL CONDUCTIVITY OF [URANIUM + ALUMINUM] ALLOYS

(U + Al > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Composition (weight percent) Al	Composition (continued), Specifications and Remarks
1	591	C	1963	338.2	< 1.6		58.4	Bal	Fe < 0.1, Si < 0.07, Ca < 0.04, and B < 0.02; prepared by the dissolution of reactor-grade Uranium (> 99.5 purity) in aluminum (99.99 purity) at approximately 100 C above the alloy liquidus temperatures and then cast in a graphite mould at 100 C.
2	591	C	1963	338.2	< 4.0		58.4	Bal	Fe < 0.1, Si < 0.07, Ca < 0.04, and B < 0.02; same as the above specimen except measured after heat-treated at 620 C for 5 days.

DATA TABLE NO. 224 THERMAL CONDUCTIVITY OF [URANIUM + ALUMINUM] ALLOYS

(U + Al > 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivities, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
338.2	0.561
338.2	0.556
338.2	0.565
CURVE 2*	
338.2	0.343
338.2	0.335

* No graphical presentation

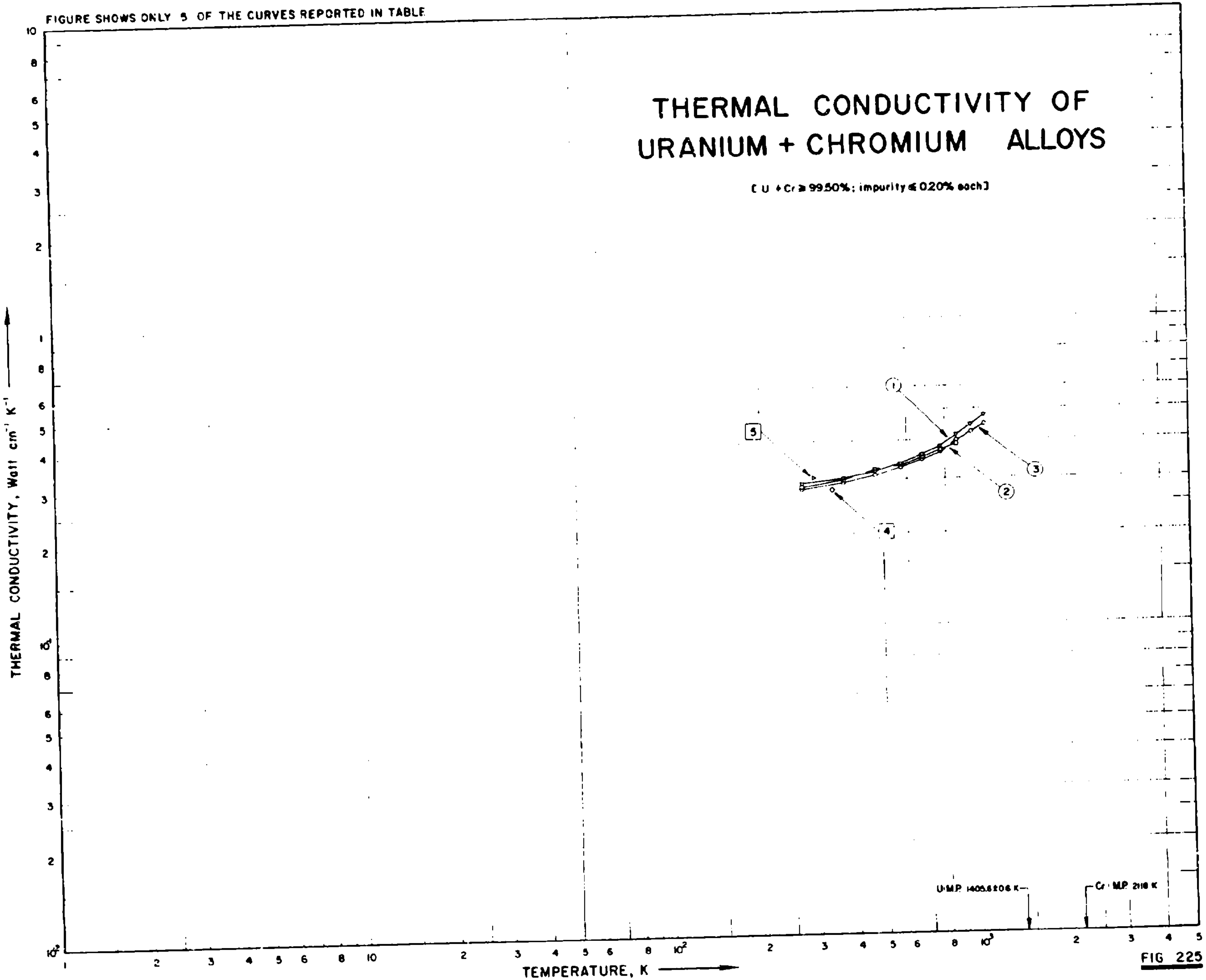


FIGURE SHOWS ONLY 5 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
URANIUM + CHROMIUM ALLOYS
[U + Cr ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
U-M.P. 1405.6±0.6 K
Cr-M.P. 2118 K
1
2
3
4
5

FIG 225

SPECIFICATION TABLE NO. 225 THERMAL CONDUCTIVITY OF [URANIUM + CHROMIUM] ALLOYS

(U + Cr > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 225]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Cr	Composition (continued), Specifications and Remarks
1	269	C	1954	273-1073	± 5	88	94.8	5.2	Biscuit U. specimen 2 cm in diameter and 15 cm long; eutectic; cast in cold graphite; measured in vacuum ~ 5 x 10^{-5} mm Hg; Armco ingot iron used as comparative material
2	269	C	1954	273-873	± 5	90-2	94.8	5.2	Similar to the above specimen, except specimen cast in copper.
3	269	C	1954	273-1073	± 5	774	94.8	5.2	Similar to the above specimen except specimen cast in warm graphite.
4	394	C	1955	343.2	± 3	7B1	99.5	0.5	Specimen supplied by Argonne National Lab.; as rolled.
5	557	P	1953	298.2			94.71	5.29	Eutectic.
6	356	C	1954	293-1073			95.0	5.0	Thermal conductivity data obtained from the average values of 4 specimens.

DATA TABLE NO. 225 THERMAL CONDUCTIVITY OF [URANIUM + CHROMIUM] ALLOYS

(U + Cr ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		**CURVE 6***	
273.2	0.293	293.2	0.29
373.2	0.304	373.2	0.30
473.2	0.319	473.2	0.32
573.2	0.338	573.2	0.34
673.2	0.360	673.2	0.36
773.2	0.383	773.2	0.38
873.2	0.415	873.2	0.40
973.2	0.444	973.2	0.43
1073.2	0.477	1073.2	0.46
CURVE 2			
273.2	0.285		
373.2	0.301		
473.2	0.321		
573.2	0.338		
673.2	0.356		
773.2	0.372		
873.2	0.389		
CURVE 3			
273.2	0.282		
373.2	0.295		
473.2	0.310		
573.2	0.330		
673.2	0.350		
773.2	0.371		
873.2	0.396		
973.2	0.423		
1073.2	0.448		
CURVE 4			
343.2	0.277		
CURVE 5			
298.2	0.306		

*Not shown on plot

SPECIFICATION TABLE NO. 226 THERMAL CONDUCTIVITY OF (URANIUM + IRON) ALLOYS

(U + Fe > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Fe	Composition (continued), Specifications and Remarks
1	557	P	1953	298.2			89.9	10.1	Eutectic.

DATA TABLE NO. 226 THERMAL CONDUCTIVITY OF (URANIUM + IRON) ALLOYS

(U + Fe > 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1[a]	
298.2	0.0917

[a] No graphical presentation

SPECIFICATION TABLE NO. 227 THERMAL CONDUCTIVITY OF [URANIUM + MAGNESIUM] ALLOYS

(U + Mg > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Mg	Composition (continued), Specifications and Remarks
1	295		1952	523, 653			73.5	26.5	Extruded powder specimen.

DATA TABLE NO. 227 THERMAL CONDUCTIVITY OF [URANIUM + MAGNESIUM] ALLOYS

(U + Mg > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
523.2	1.130
653.2	1.100

* No graphical presentation

FIGURE SHOWS ONLY 6 OF THE CURVES REPORTED IN TABLE

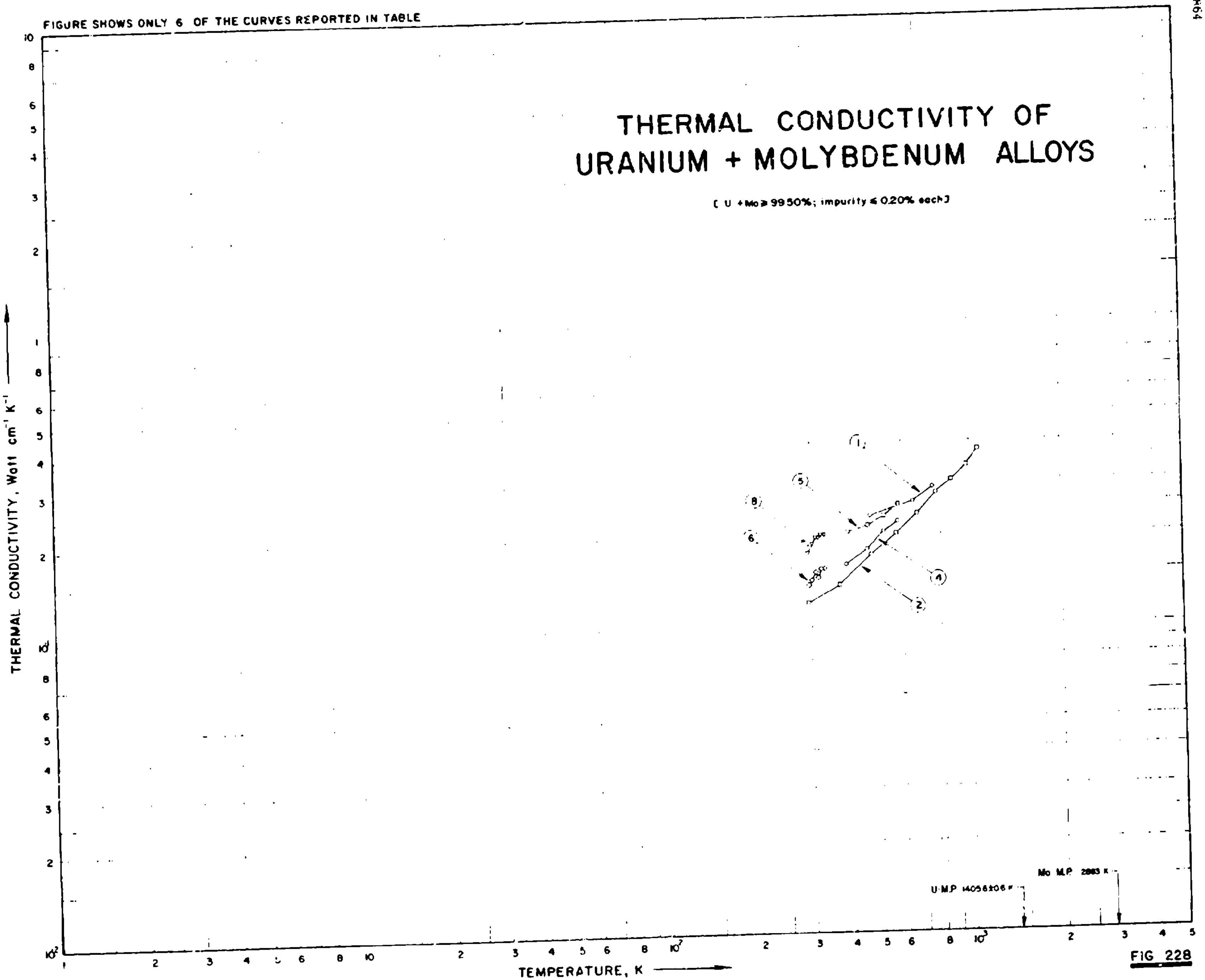


FIG. 228

SPECIFICATION TABLE NO. 228 THERMAL CONDUCTIVITY OF [URANIUM + MOLYBDENUM] ALLOYS

(U + Mo > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 228]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Mo	Composition (continued), Specifications and Remarks
1	46		1958	473-760			94.6	5.4	No details reported.
2	538	L	1956	293-1073			90	10	Measured under vacuo of ~1 x 10^{-5} mm Hg.
3	392		1945	398-585			95	5	Metastable gamma state.
4	392		1945	393-583			95	5	The above specimen annealed for 40 hrs. at 520 C; alpha state.
5	392		1945	398-583			95	5	The above specimen water quenched from 700 C; gamma state.
6	730	L	1945	295-332	2	C-270-5	95	5	Specimen as rolled rod.
7	730	L	1945	302-334	2	C-270-10 B	95	5	Similar to the above specimen but annealed 2 hr. at 850 C, then water quenched.
8	730	L	1945	294-333	2	C-270-10 A	95	5	Similar to the above specimen but annealed 2 hr. at 850 C, furnace cooled to 200 C then water quenched.

DATA TABLE NO. 228 THERMAL CONDUCTIVITY OF URANIUM + MOLYBDENUM ALLOYS

(U + Mo ≥ 99.50%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
473.2	0.230
653.2	0.265
760.2	0.285
CURVE 2	
293.2	0.121
373.2	0.138
473.2	0.173
573.2	0.201
673.2	0.23[illegible]
773.2	0.272
873.2	0.301
973.2	0.335
1073.2	0.375
CURVE 3*	
398.2	0.160
463.2	0.180
528.2	0.205
583.2	0.220
CURVE 4	
333.2	0.160
461.2	0.180
523.2	0.205
583.2	0.220
CURVE 5	
398.2	0.205
463.2	0.215
523.2	0.230
583.2	0.250
CURVE 6	
296.3	0.138
302.2	0.142
311.5	0.151
CURVE 6 (cont.)	
318.7	0.145
324.4	0.155
332.9	0.155
CURVE 7	
301.6	0.158
303.7	0.146
311.6	0.151
324.5	0.159
334.4	0.163
CURVE 8	
294.2	0.176
304.7	0.188
311.7	0.197
318.9	0.197
324.5	0.201
332.6	0.201

* Not shown on plot

SPECIFICATION TABLE NO. 229 THERMAL CONDUCTIVITY OF [URANIUM + NIOBIUM] ALLOYS

(U + Nb $\geq$ 99.50%; impurity $\leq$ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Nb	Composition (continued), Specifications and Remarks
	422		1945	400–619			96	4	

DATA TABLE NO. 229 THERMAL CONDUCTIVITY OF [URANIUM + NIOBIUM] ALLOYS

(U + Nb $\geq$ 99.50%; impurity $\leq$ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
399.7	0.220
478.2	0.245
548.7	0.258
618.7	0.275

* No graphical presentation

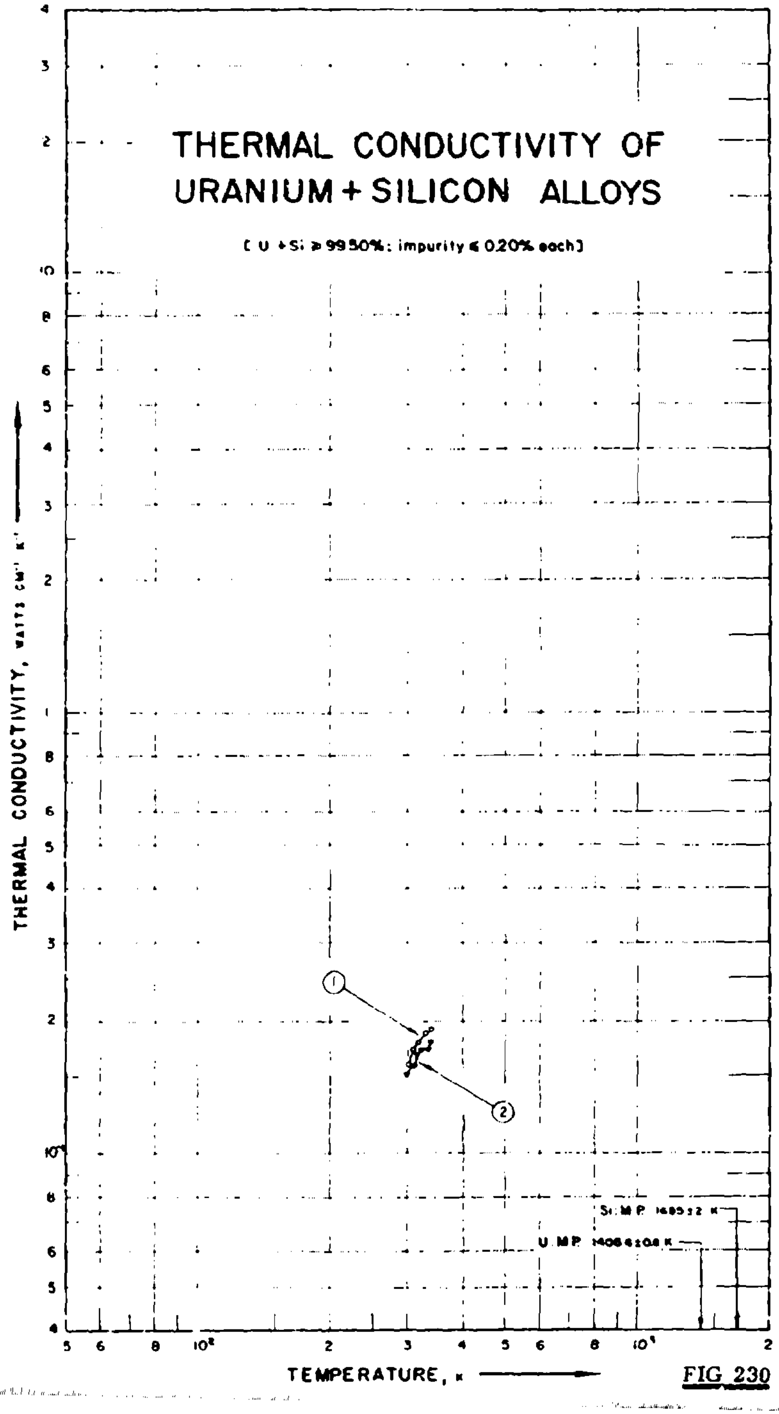

THERMAL CONDUCTIVITY OF
URANIUM + SILICON ALLOYS
[U + Si ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹
TEMPERATURE, K
Si: M.P. 1685±2 K
U: M.P. 1406±2.08 K
1
2

FIG 230

SPECIFICATION TABLE NO. 230 THERMAL CONDUCTIVITY OF [URANIUM + SILICON] ALLOYS

(U + Si ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 230]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Si	Composition (continued), Specifications and Remarks
1	730	L	1945	301-340	2	E-19	81	19	Heat treated; specimen homogeneous in the [illegible]-phase.
2	730	L	1945	298-339	2	E-23	77	23	Similar to the above specimen.

DATA TABLE NO. 230 THERMAL CONDUCTIVITY OF [URANIUM + SILICON] ALLOYS

(U + Si > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
301.0	0.159
308.8	0.172
319.2	0.180
330.9	0.188
339.6	0.192
CURVE 2	
298.1	0.151
310.5	0.159
315.7	0.167
324.4	0.172
333.9	0.172
339.2	0.180

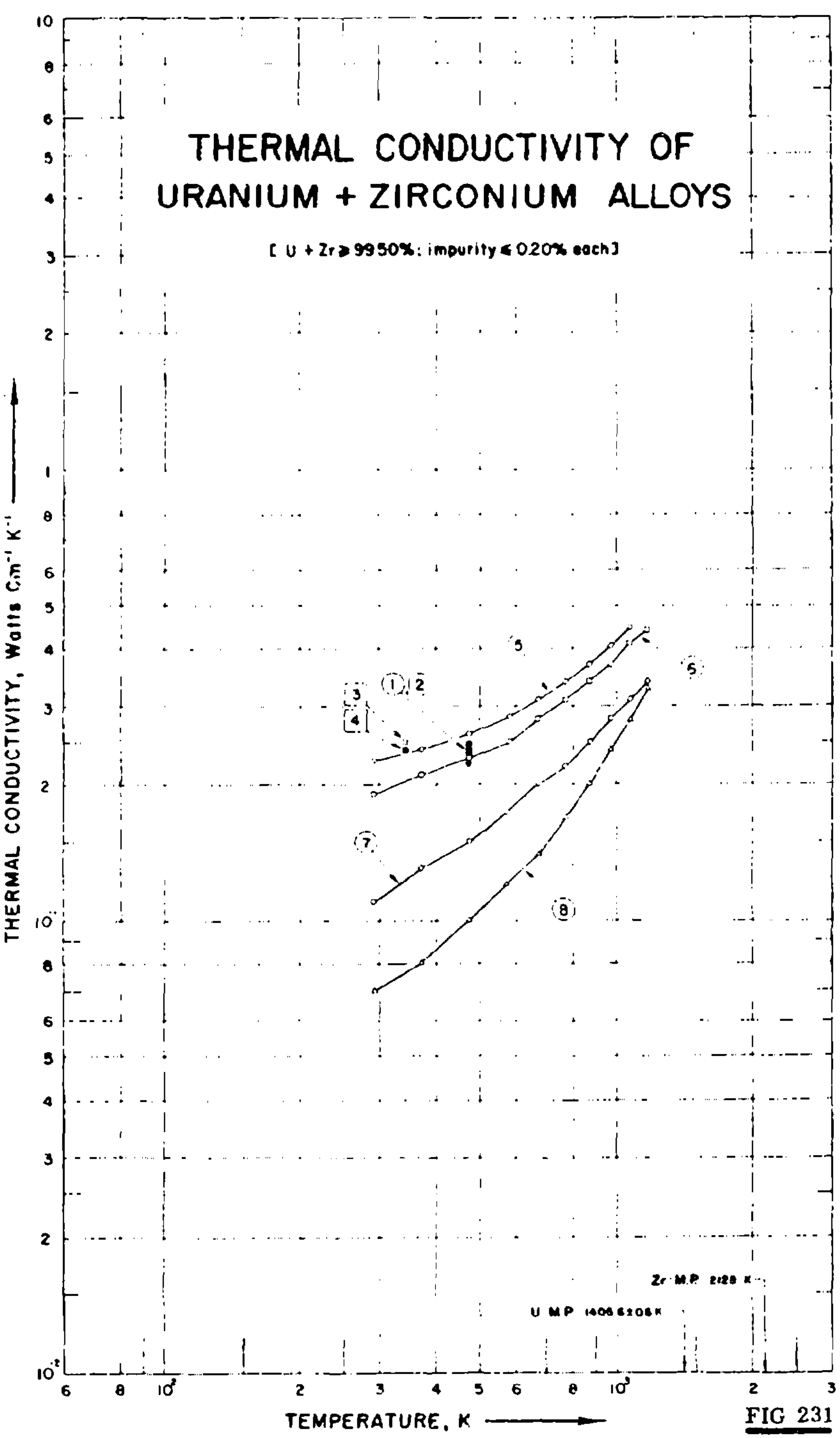

THERMAL CONDUCTIVITY OF
URANIUM + ZIRCONIUM ALLOYS
[U + Zr ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Zr M.P. 2128 K
U M.P. 1406 ± 2.08 K
1
2
3
4
5
6
7
8

FIG 231

SPECIFICATION TABLE NO. 231 THERMAL CONDUCTIVITY OF URANIUM + ZIRCONIUM, ALLOYS

(U + Zr ≥ 99.50%, impurity ≤ 0.20% each)

For Data Reported in Figure and Table No. 231R

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Zr	Composition (continued), Specifications and Remarks
1	393	C	1955	473.2	±10	ANL AA-20(hot)	98.4	1.6	10.0 U 235 enriched; irradiated. 0.75 (at. %) burn up.
2	393	C	1955	473.2	±10	ANL AA-22(hot)	98.4	1.6	Similar to the above specimen except 0.21 (at. %) burn up.
3	394	C	1955	343.2	±3	3 B 1	98.9	1.1	As rolled.
4	394	C	1955	343.2	±3	4 B 4	98.5	1.5	As rolled.
5	395	C	1958	293-1073	±5		98.5	1.5	Measured in vacuo; zircaloy -2 used as standard.
6	396		1954	293-1173			95.0	5.0	No details reported.
7	396		1954	293-1173			80.0	20.0	No details reported.
8	396		1954	293-1173			60.0	40.0	No details reported.

DATA TABLE NO. 231 THERMAL CONDUCTIVITY OF [URANIUM + ZIRCONIUM] ALLOYS

(U + Zr > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
473.2	0.222
473.2	0.243
473.2	0.234
473.2	0.247
473.2	0.238
CURVE 2	
473.2	0.226
473.2	0.247
473.2	0.243
473.2	0.251
473.2	0.247
CURVE 3	
343.2	0.249
CURVE 4	
343.2	0.239
CURVE 5	
293.2	0.226
373.2	0.240
473.2	0.260
573.2	0.285
673.2	0.310
773.2	0.340
873.2	0.370
973.2	0.405
1073.2	0.445
CURVE 6	
293.2	0.19
373.2	0.21
473.2	0.23
573.2	0.25
673.2	0.28
773.2	0.31
CURVE 6 (cont.)	
873.2	0.34
973.2	[illegible]
1073.2	0.41
1173.2	0.44
CURVE 7	
293.2	0.11
373.2	0.13
473.2	0.15
573.2	0.17
673.2	0.20
773.2	0.22
873.2	0.25
973.2	0.28
1073.2	0.31
1173.2	0.34
CURVE 8	
293.2	0.07
373.2	0.08
473.2	0.10
573.2	0.12
673.2	0.14
773.2	0.17
873.2	0.20
973.2	0.24
1073.2	0.28
1173.2	0.33

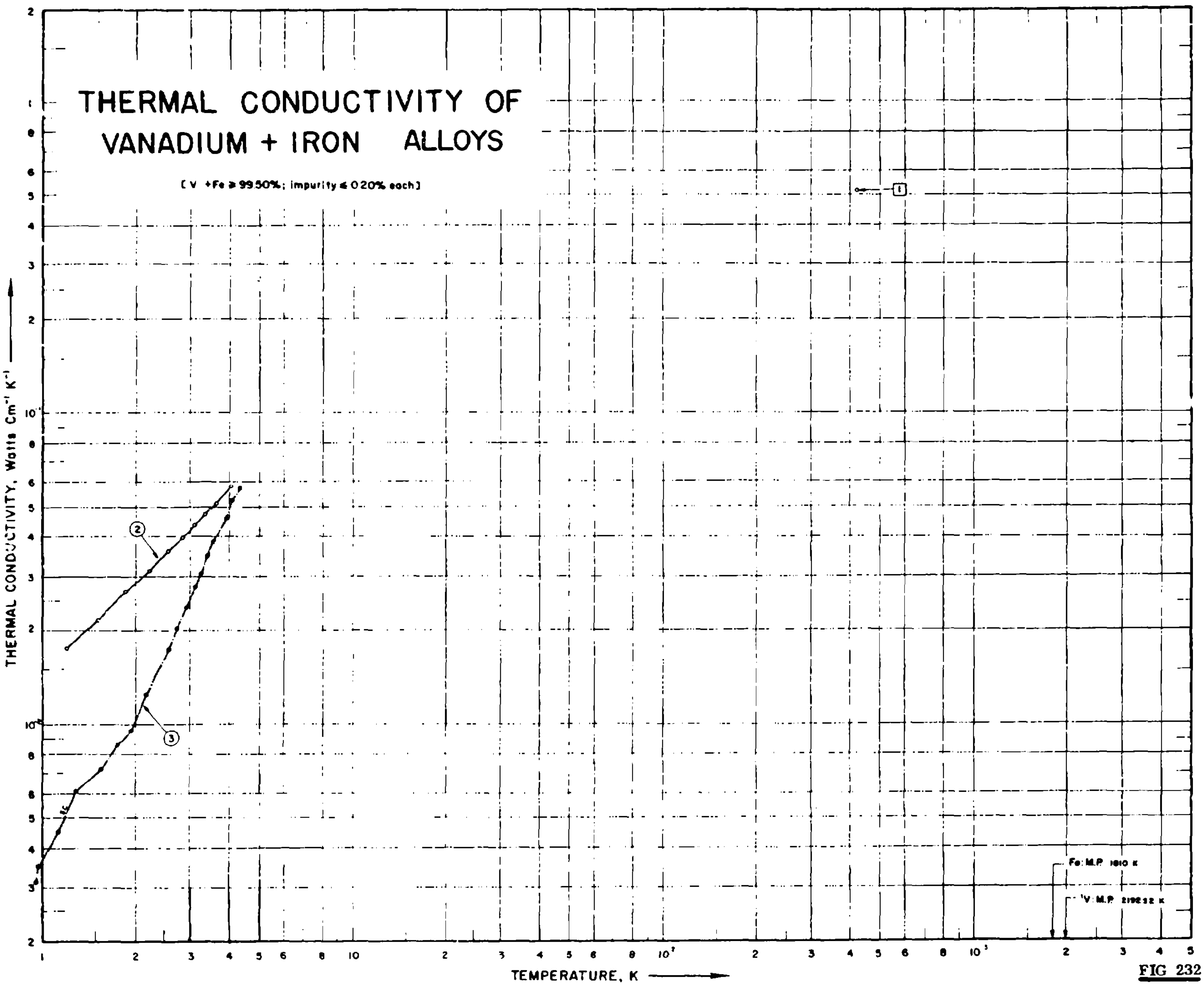

THERMAL CONDUCTIVITY OF VANADIUM + IRON ALLOYS
[V + Fe ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Fe: M.P. 1810 K
V: M.P. 2192±2 K
1
2
3

FIG 232

SPECIFICATION TABLE NO. 232 THERMAL CONDUCTIVITY OF [VANADIUM + IRON] ALLOYS

(V + Fe ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 232]

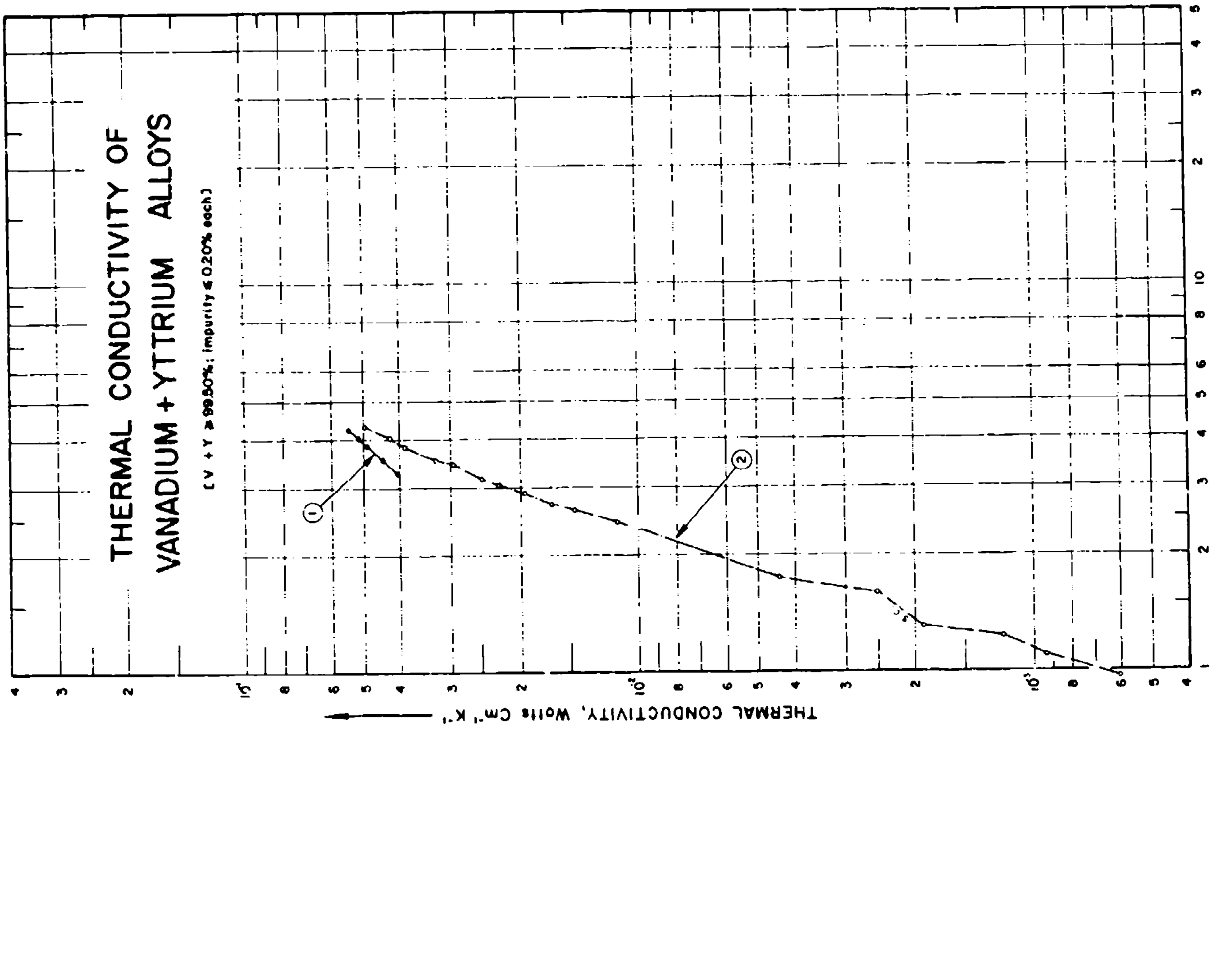
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) V	Fe	Composition (continued), Specifications and Remarks
1	204	L	1937	423.2		Russian ferrovanadium, 36	83	16.86	0.14 C.
2	501		1961	1.2-4.1		V1	99.761	0.2	0.02 Si, 0.005 Cu, 0.002 Ti, 0.002 Mo, 0.01 Mn; single crystal; specimen obtained by the floating-zone melting of polycrystalline rod; in normal state in a field of 6200 oersteds.
3	501		1961	0.95-4.4		V1	99.761	0.2	0.02 Si, 0.005 Cu, 0.002 Ti, 0.002 Mo, 0.01 Mn; the above specimen in superconducting state.

DATA TABLE NO. 232 THERMAL CONDUCTIVITY OF [VANADIUM + IRON] ALLOYS

(V + Fe $\geq$ 99.50%; impurity $\leq$ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
423.2	0.516
CURVE 2	
1.20	0.0175
1.52	0.0215
1.86	0.0266
2.21	0.0311
2.55	0.0359
2.85	0.0395
3.10	0.0434
3.35	0.0475
3.65	0.0511
4.05	0.0580
CURVE 3	
0.95	0.0031
0.97	0.0035
1.13	0.0045
1.29	0.0061
1.55	0.0071
1.75	0.0085
1.94	0.0095
2.16	0.0124
2.56	0.0174
2.73	0.0201
2.93	0.0236
3.11	0.0276
3.25	0.0305
3.44	0.0347
3.59	0.0385
3.93	0.0458
4.13	0.0521
4.35	0.0572



THERMAL CONDUCTIVITY OF VANADIUM + YTTRIUM ALLOYS
(V + Y ≥ 99.50%; impurity ≤ 0.20% each)
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 233

SPECIFICATION TABLE NO. 233 THERMAL CONDUCTIVITY OF VANADIUM + YITTRIUM ALLOYS

(V + Y 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 233]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) V	Y	Composition (continued), Specifications and Remarks
1	501		1961	3.3-4.3			>99.35	0.11	0.09 Fe, 0.21 Si, 0.08 N, 0.05 C, and O < 0.01; polycrystal; in normal state in a field of 4600 oersteds.
2	501		1961	0.97-4.3					The above specimen in superconducting state.

DATA TABLE NO. 233 THERMAL CONDUCTIVITY OF (VANADIUM + YTTRIUM) ALLOYS

(V + Y >99.50%; impurity <0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
3.28	0.0402
3.55	0.0442
3.85	0.0487
4.05	0.0514
4.25	0.0544
CURVE 2	
0.97	0.00060
1.10	0.00093
1.24	0.0012
1.31	0.0019
1.60	0.0025
1.75	0.0044
2.45	0.0113
2.62	0.0145
2.72	0.0165
2.90	0.0195
3.04	0.0224
3.16	0.0248
3.45	0.0294
3.53	0.0325
3.84	0.0387
4.05	0.0422
4.31	0.0495

SPECIFICATION TABLE NO. 231 THERMAL CONDUCTIVITY OF [ZINC + ALUMINUM] ALLOYS

(Zn + Al ≥ 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zn	Al	Composition (continued), Specifications and Remarks
1	17	R	1958	293-353	± 1.0	Zamak Nr 400	95.51	4.15	0.027 Cu, 0.032 Si, 0.037 Mg, 0.007 Fe, trace Bi, Cd, Pb, Sn, and Tl.
2	230	L	1925	323.2			60.0	40.0	Impurities 0.03.

DATA TABLE NO. 231 THERMAL CONDUCTIVITY OF [ZINC + ALUMINUM] ALLOYS

(Zn + Al ≥ 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
293.2	1.17
323.2	1.17
353.2	1.17
CURVE 2*	
323.2	1.19

* No graphical presentation

SPECIFICATION TABLE NO. 235 THERMAL CONDUCTIVITY OF [ZINC + CADMIUM] ALLOYS

(Zn + Cd > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zn	Cd	Composition (continued), Specifications and Remarks
1	230	L	1925	326.2			60.0	40.6	Impurities < 0.03.
2	230	L	1925	326.2			70.0	30.0	Impurities < 0.03.
3	230	L	1925	326.2			80.0	20.0	Impurities < 0.03.
4	230	L	1925	326.2			95.0	5.0	Impurities < 0.03.

DATA TABLE NO. 235 THERMAL CONDUCTIVITY OF [ZINC + CADMIUM] ALLOYS

(Zn + Cd > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1*	
326.2	1.042
CURVE 2*	
326.2	1.067
CURVE 3*	
326.2	1.088
CURVE 4*	
326.2	1.126

* No graphical presentation

SPECIFICATION TABLE NO. 236 THERMAL CONDUCTIVITY OF [ZIRCONIUM + ALUMINUM] ALLOYS

(Zr + Al > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Al	Composition (continued), Specifications and Remarks
1	554		1954	318.7			96	4	
2	555	C	1956	406.2			97	3	Melted in a nonconsumable electrode arc furnace.

DATA TABLE NO. 236 THERMAL CONDUCTIVITY OF [ZIRCONIUM + ALUMINUM] ALLOYS

(Zr + Al > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
318.7	0.0837
CURVE 2*	
406.2	0.0828

* No graphical presentation

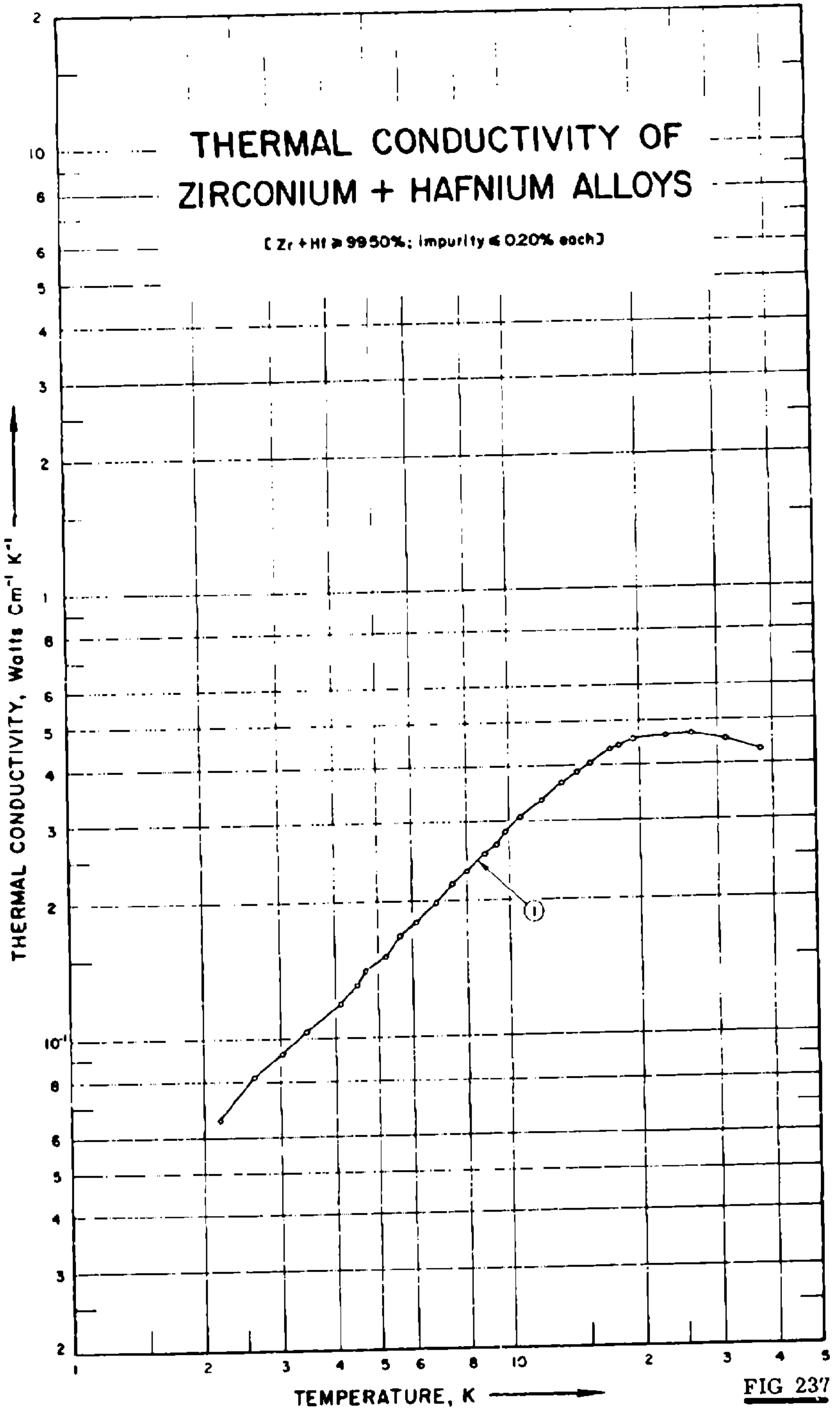

THERMAL CONDUCTIVITY OF
ZIRCONIUM + HAFNIUM ALLOYS
[Zr + Hf ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
1

FIG 237

SPECIFICATION TABLE NO. 237 THERMAL CONDUCTIVITY OF [ZIRCONIUM + HAFNIUM] ALLOYS

(Zr + Hf > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 237]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Hf	Composition (continued), Specifications and Remarks
1	122	L	1955	2.2-38	3	Zr 2	~98	~2	Polycrystalline specimen (large crystals), 3.07 cm long, 0.44 cm dia., annealed; supplied by Metro Vickers.

DATA TABLE NO. 237 THERMAL CONDUCTIVITY OF (ZIRCONIUM + HAFNIUM) ALLOYS

($Zr + Hf \geq 99.50\%$, impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
2.18	0.0658
2.62	0.0821
3.04	0.0927
3.45	0.104
4.07	0.119
4.50	0.131
4.71	0.141
5.25	0.152
5.65	0.168
6.14	0.180
6.83	0.198
7.42	0.219
8.04	0.238
8.83	0.255
9.42	0.266
9.90	0.285
10.80	0.307
12.00	0.335
13.34	0.366
14.59	0.387
15.50	0.405
17.20	0.433
18.00	0.444
19.50	0.459
23.00	0.469
26.42	0.471
31.50	0.456
37.90	0.431

SPECIFICATION TABLE NO. 238 THERMAL CONDUCTIVITY OF [ZIRCONIUM + NIOBIUM] ALLOYS

(Zr + Nb > 99.50%; impurity < 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Nb	Composition (continued), Specifications and Remarks
1	441	E	1957	342-899			98.26	1.52	0.14 Hf, 0.08 C.

DATA TABLE NO. 238 THERMAL CONDUCTIVITY OF [ZIRCONIUM + NIOBIUM] ALLOYS

(Zr + Nb > 99.50%; impurity < 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
342.2	0.213
391.2	0.213
479.1	0.210
514.9	0.210
562.0	0.213
632.2	0.216
680.9	0.219
753.8	0.227
834.2	0.235
898.7	0.242

* No graphical presentation

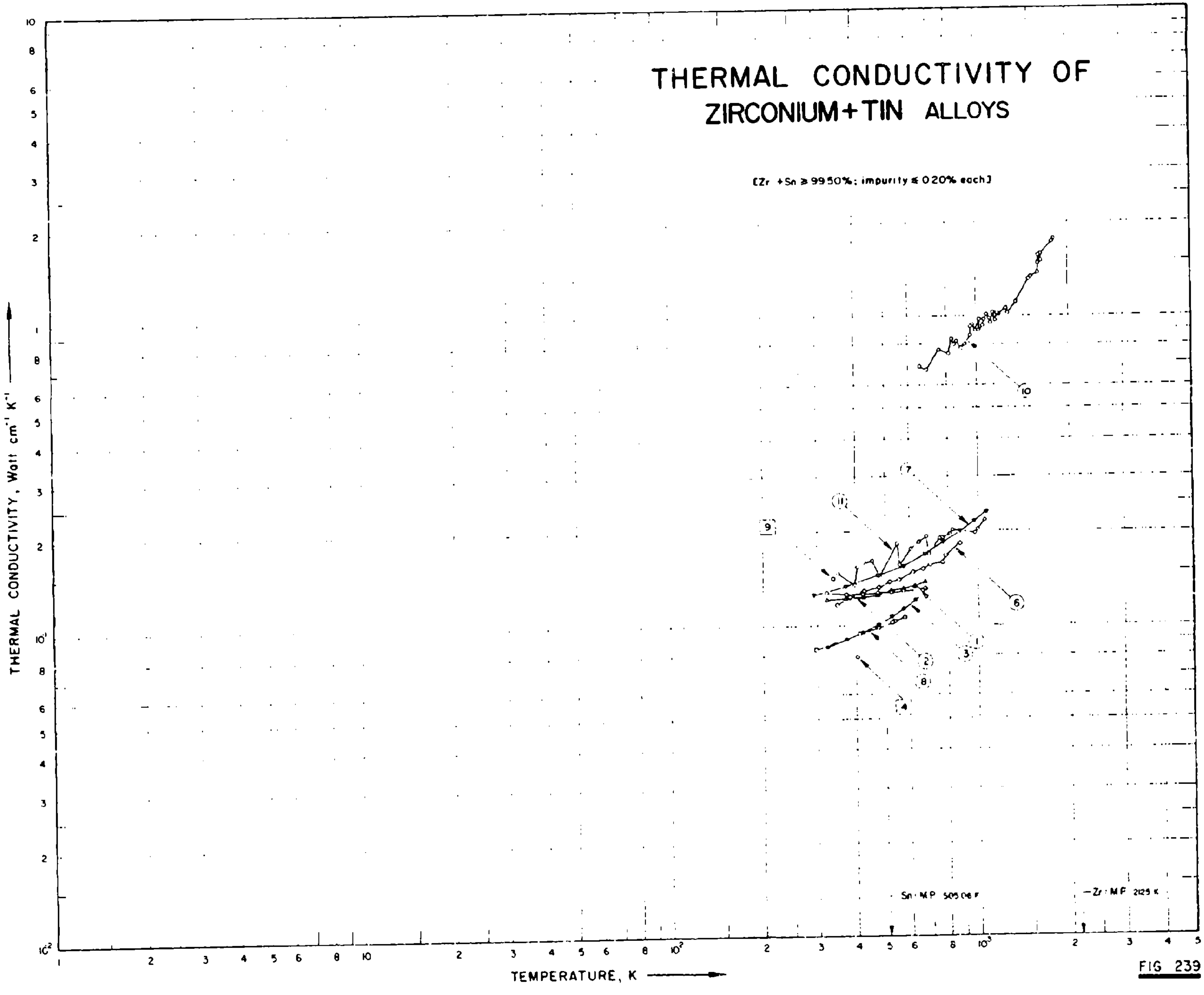

THERMAL CONDUCTIVITY OF
ZIRCONIUM+TIN ALLOYS
[Zr + Sn ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
Sn: M.P. 505.08 K
Zr: M.P. 2125 K
1
2
3
4
6
7
8
9
10
11

FIG 239

SPECIFICATION TABLE NO. 239 THERMAL CONDUCTIVITY OF ZIRCONIUM + TIN ALLOYS

(Zr + Sn ≥ 99.50%; impurity ≤ 0.20% each)

For Data Reported in Figure and Table No. 239

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Sn	Composition (continued), Specifications and Remarks
1	27	C	1953	323-673		315	97.485	2.510	0.005 N_2; specimen 2 cm dia, 15 cm long; arc-melted and forged at 1700 F; Armco iron used as standard.
2	27	C	1953	323-673		370	97.698	2.300	0.002 N_2; specimen 2 cm dia, 15 cm long; arc-melted and forged at 1600 F; Armco iron used as standard.
3	27	C	1953	323-673		1009	93.0	7.0	Prepared from Foote grade I crystal bar Zr and c.p. Sn; arc-melted; Armco iron as standard.
4	555	C	1956	404.2			90	10	Melted in a nonconsumable electrode arc furnace.
5	555	C	1956	407.2			93	7	Melted in a nonconsumable electrode arc furnace.
6	101	L	1955	348-873	3		97.0	3.0	Specimen 7.938 in. long, 0.787 in. dia; supplied by Westinghouse; melted in vacuum furnace, forged at 845 C in argon; annealed 0.5 hr at 1000 C in vacuo.
7	395	C	1958	293-1073	±5	Zircaloy - 2	98.2	1.5	0.15 Fe, 0.10 Cr, 0.05 Ni (nominal composition from Metals Handbook).
8	442	C	1951	298-573	±3	3E	95	5	Induction melted from low-hafnium Bureau of Mines; sponge in graphite mold; forged in 1800 F in air.
9	591	C	1963	338.2	1.5	Zircaloy - 2	98.5	1.5	Hot rolled; copper used as standard.
10	930	R	1966	659-1793		Zircaloy - 4	Bal	0.61	Typical composition with impurities as received 0.23 Fe, 0.16 Mg, 0.086 Cr, 0.0176 Cu, < 0.01 each of Hf and W, 0.0043 N_2, 0.0038 C, 0.0024 each of Al, Mn and Si, 0.0018 Ti, 0.0012 Ni, < 0.001 Co, < 0.0001 each of B and Cd; specimen exposed 100 hrs at 400 to 800 C with impurities 7.5 Mg, 1.16 Sn, 0.24 Fe, 0.087 Cr, 0.0216 Cu, 0.013 Hf, < 0.01 W, 0.0042 N_2, 0.0037 C, 0.0032 Mn, 0.0023 Al, 0.0028 Si, 0.0019 Ti, trace Co, Ni, B and Cd; exposed 206 hrs at 400 to 1500 C with impurities of 0.36 Sn, 0.19 Fe, 0.0815 Cr, 0.021 N_2, 0.0152 Cu, < 0.01 each of Hf and W, 0.0087 Al, 0.0052 C, 0.0046 Si, trace Mn, Mg, Ti, Co, Ni, B and Cd.
11	931	L, C	1965	351-1058	±5	Zircaloy - 4	Bal	1.2-1.7	0.18-0.24 Fe, 0.07-0.13 Cr (0.28-0.38 total impurities of Fe + Ni + Cr); nickel used as comparative material.

DATA TABLE NO. 239 THERMAL CONDUCTIVITY OF [ZIRCONIUM + TIN] ALLOYS

(Zr + Sn ≥ 99.50%, impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
323.20	0.127
373.20	0.126
423.20	0.126
473.20	0.127
523.20	0.127
573.20	0.128
623.20	0.129
673.20	0.131
CURVE 2	
323.20	0.121
373.20	0.122
423.20	0.124
473.20	0.126
523.20	0.128
573.20	0.131
623.20	0.134
673.20	0.137
CURVE 3	
323.20	0.0856
373.20	0.0900
423.20	0.0948
473.20	0.101
523.20	0.107
573.20	0.114
623.20	0.122
673.20	0.131
CURVE 4	
404.2	0.0795
CURVE 5	
407.2	0.0937
CURVE 6	
347.50	0.117
383.60	0.124
CURVE 6 (cont.)	
427.50	0.128
477.20	0.133
514.20	0.137
551.20	0.140
616.00	0.149
661.80	0.152
698.00	0.157
766.60	0.160
787.40	0.168
873.20	0.183
CURVE 7	
293.2	0.126
373.2	0.134
473.2	0.145
573.2	0.156
673.2	0.170
773.2	0.184
873.2	0.199
973.2	0.215
1073.2	0.231
CURVE 8	
298.2	0.084
323.2	0.086*
373.2	0.090*
415.2	0.094
423.2	0.095*
473.2	0.098
523.2	0.103
533.2	0.104
573.2	0.107
CURVE 9	
338.2	0.142
CURVE 10	
659.2	0.686
693.2	0.674
CURVE 10 (cont.)	
764.2	0.766
816.2	0.749
837.2	0.833
852.2	0.799
866.2	0.816
898.2	0.778
921.2	0.799
96[illegible].2	0.858
963.2	0.920
978.2	0.933
990.2	0.904
999.2	0.891*
1034.2	0.975
1034.2	0.891
1055.2	0.925
1063.2	0.971
1075.2	0.971*
1084.2	1.008
1113.2	0.983
1129.2	0.950
1147.2	1.033
1158.2	0.967
1171.2	1.029
1182.2	1.013
1253.2	1.063
1263.2	1.029
1275.2	1.059*
1353.2	1.109
1497.2	1.301
1512.2	1.322
1600.2	1.364
1603.2	1.460
1607.2	1.556
1648.2	1.569
1648.2	1.494
1779.2	1.732
1793.2	1.761
CURVE 11	
350.9	0.147
397.0	0.136
403.2	0.156
CURVE 11 (cont.)	
452.1	0.163
476.5	0.145
546.5	0.183
557.6	0.158
602.6	0.176
645.9	0.185
682.1	0.192
694.3	0.171
753.2	0.189
770.3	0.189
812.1	0.196
826.5	0.201
982.1	0.197
1000.9	0.203
1058.1	0.217

* Not shown on plot

SPECIFICATION TABLE NO. 240 THERMAL CONDUCTIVITY OF [ZIRCONIUM + TITANIUM] ALLOYS

(Zr + Ti > 99.50%; impurity ≤ 0.20% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Ti	Composition (continued), Specifications and Remarks
1	554		1954	319.7			93	7	

DATA TABLE NO. 240 THERMAL CONDUCTIVITY OF [ZIRCONIUM + TITANIUM] ALLOYS

(Zr + Ti > 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
319.7	0.130

* No graphical presentation

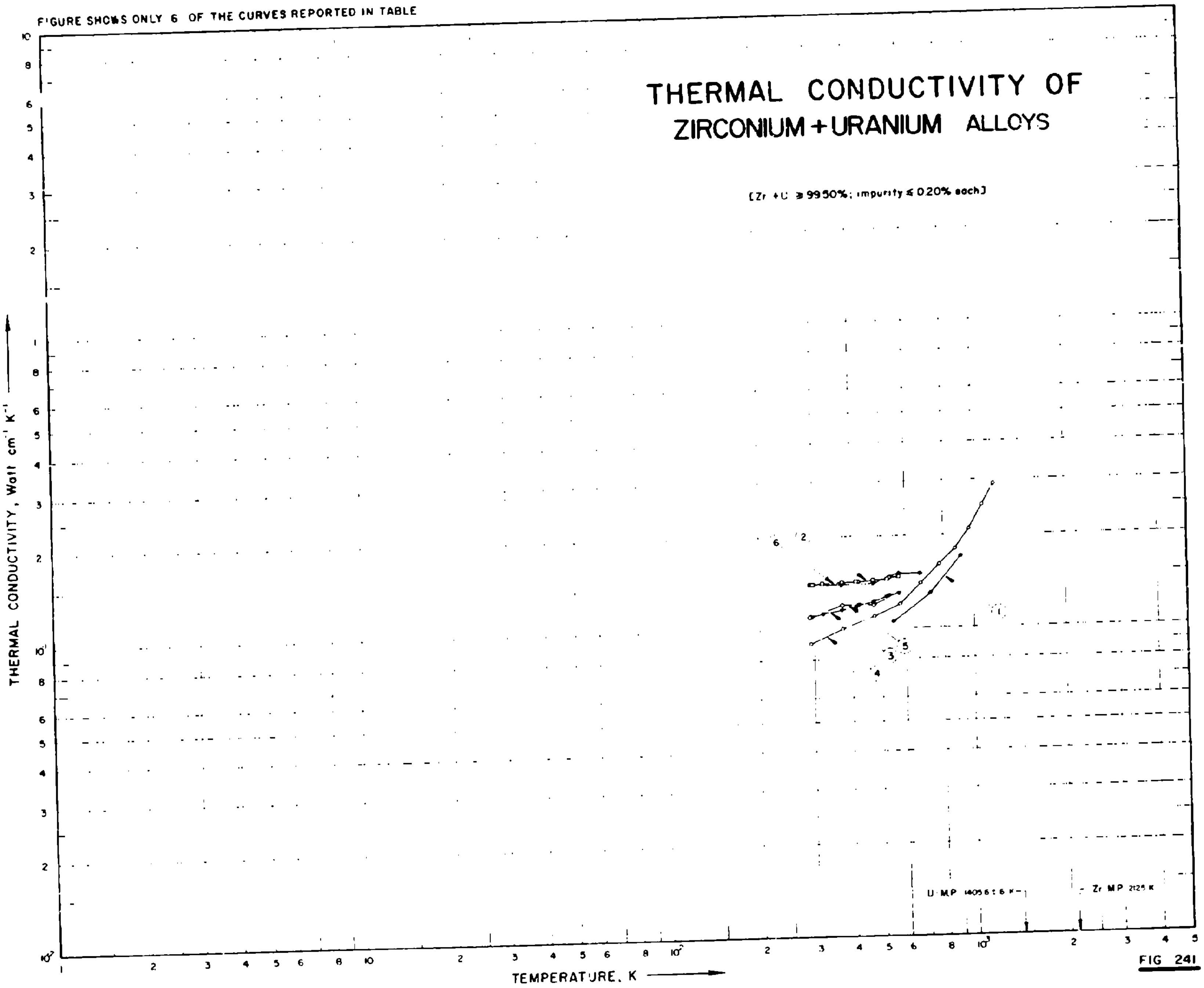


FIGURE SHOWS ONLY 6 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
ZIRCONIUM + URANIUM ALLOYS
[Zr + U ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
U M.P. 1405.6 ± 6 K
Zr M.P. 2125 K
1
2
3
4
5
6

FIG 241

SPECIFICATION TABLE NO. 241 THERMAL CONDUCTIVITY OF (ZIRCONIUM + URANIUM) ALLOYS

(Zr + U ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 241]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	U	Composition (continued), Specifications and Remarks
1	295	C	1952	548-913	± 5		70.3	29.7	Extruded; specimen 0.75 in. dia; 9 in. long.
2	442	C	1951	298-573	± 3	5	97	3	Electrical resistivity 67.8, 71.1, and 102.5 μohm cm at 0, 25, and 260 C, respectively. ~~ρ_0 = 67.8 μohm cm~~
3	442		1951	298-573		6	86	14	Electrical resistivity 82.2, 85.5, and 116.0 μohm cm at 0, 25, and 260 C, respectively. ~~ρ_0 = 82.2 μohm cm~~
4	396		1954	293-1173			70	30	No details reported.
5	396		1954	293-573			86	14	No details reported.
6	396		1954	293-673			97	3	No details reported.

DATA TABLE NO. 241 THERMAL CONDUCTIVITY OF [ZIRCONIUM + URANIUM] ALLOYS

($Zr + U < 99.50\%$; impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
548.2	0.106
723.2	0.130
913.2	0.170
CURVE 2	
298.2	0.140
323.2	0.141
373.2	0.142
415.2	0.143
423.2	0.143
473.2	0.144
523.2	0.145
533.2	0.146
573.2	0.147
CURVE 3	
298.2	0.111
323.2	0.113
373.2	0.116
415.2	0.119
423.2	0.120
473.2	0.123
523.2	0.127
533.2	0.128
573.2	0.130
CURVE 4	
293.2	0.09
373.2	0.10
473.2	0.11
573.2	0.12
673.2	0.14
773.2	0.16
873.2	0.18
973.2	0.21
1073.2	0.25
1173.2	0.29

T	k
CURVE 5	
293.2	0.11
373.2	0.12
473.2	0.12
573.2	0.13*
CURVE 6	
293.2	0.14
373.2	0.14
473.2	0.14
573.2	0.15
673.2	0.15

* Not shown on plot

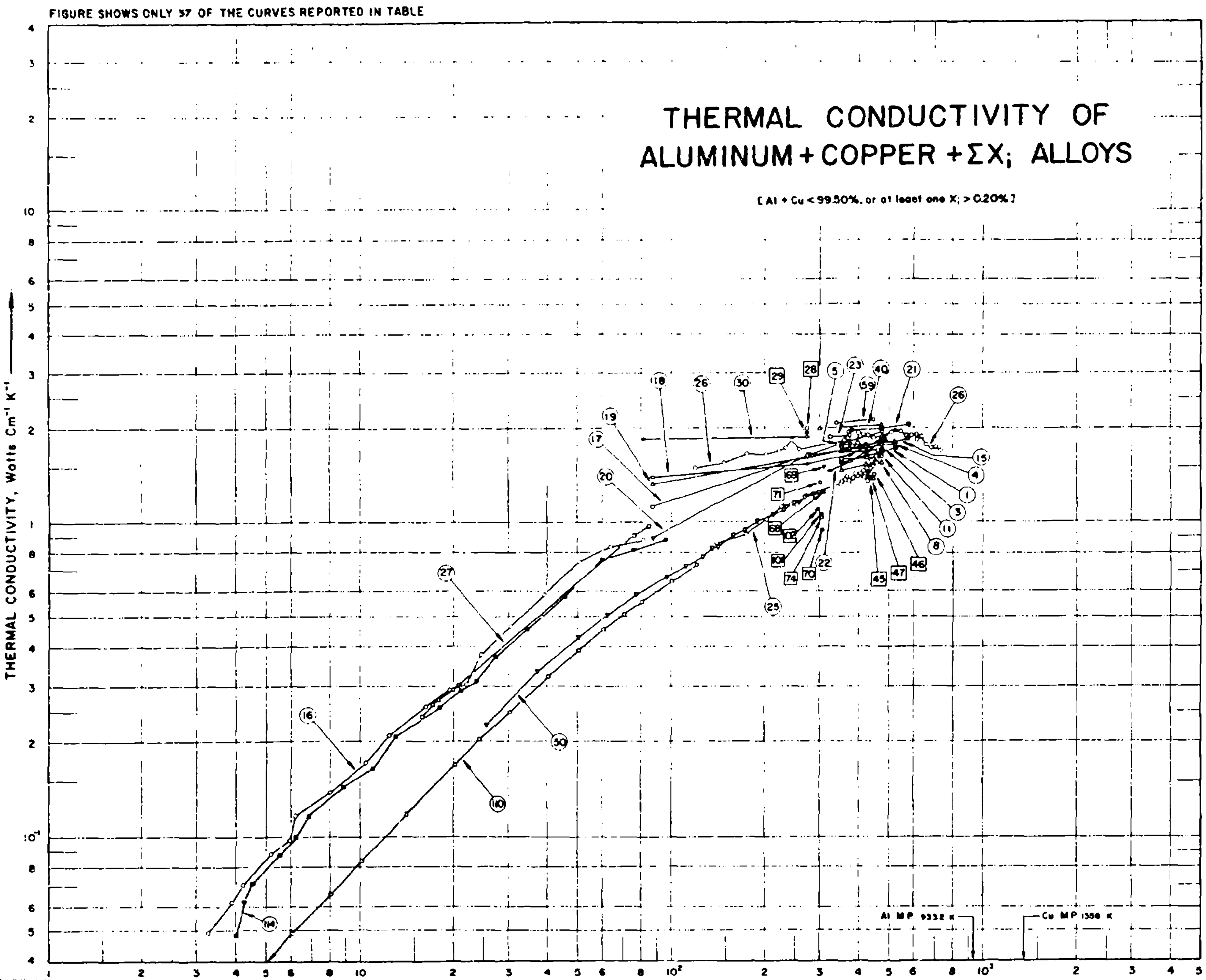


FIGURE SHOWS ONLY 37 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
ALUMINUM + COPPER + ΣXi ALLOYS
[Al + Cu < 99.50%, or at least one Xi > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
Al M.P. 933.2 K
Cu M.P. 1356 K
1
2
3
4
5
6
8
10
10²
10³
10⁻¹
16
27
50
110
114
25
18
26
30
29
28
5
23
40
59
21
19
17
20
69
71
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SPECIFICATION TABLE NO. 242 THERMAL CONDUCTIVITY OF [ALUMINUM + COPPER + ΣX_i] ALLOYS

(Al + Cu < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 242]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight per cent) Cu	Fe	Mg	Mn	Ni	Si	Zn	Composition (continued), Specifications and Remarks
1	55	PL	1928	353-523		Bar 779	12.0				3.0			Cast and annealed.
2	55	PL	1928	353-473		Bar 792	12.0				2.0			Cast and annealed.
3	55	PL	1928	353-473		Bar 766	9.0				2.0			Cast and annealed.
4	55	PL	1926	353-523		Bar 762	8.0				1.0			Cast and annealed.
5	55	PL	1928	353-473		Bar 795	8.0				3.0			Cast and annealed.
6	55	PL	1928	353-473		Bar 829	9.0		1.0		2.0			Cast and annealed.
7	55	PL	1928	353-473		Bar 888	8.0		1.5		2.0			Cast and annealed.
8	55	PL	1928	353-473		Bar 810	8.0		2.0		2.0			Cast and annealed.
9	55	PL	1928	353-473		Bar 905	4.0		1.5		2.0			Cast and annealed.
10	55	PL	1928	353-473		Bar 785	8.0	1.0						Cast and annealed.
11	55	PL	1928	353-473		Bar 789	8.0	2.0						Cast and annealed.
12	55	PL	1928	353-473		Bar 886	4.0	2.0	0.5					Cast and annealed.
13	55	PL	1928	353-473		Bar 656	8.0			1.0				Cast and annealed.
14	55	PL	1928	353-473		Bar 798	7.0							1.0 Ag; cast and annealed.
15	55	PL	1928	353-573		Bar 2311	4.0					3.0		Cast and annealed.
16	154, 587	L	1956	3.3 - 81	<5.0		4.4		1.5	0.6				Unannealed.
17	93	L	1931	87 -476	3.0-4.0	Y-Alloy	4.0		1.5		2.0			As cast.
18	93	L	1931	87 -476	3.0-4.0	Y-Alloy	4.0		1.5		2.0			Annealed.
19	93	L	1931	87 -476	3.0-4.0	Nelson-Kebbenleg 10	4.0		1.5	2.0				Cast.
20	93	L	1931	87 -476	3.0-4.0	Duralumin	3.0/ 5.0		0.5					
21	20	L	1951	380-575	<3.0	2	4.1	0.1	1.63			0.06	0.05	0.004 Ti; annealed at 300 - 500 C.
22	20	L	1951	324-526	<3.0	3	4.33	0.06	1.37			0.02	0.10	0.005 Ti; heated to 500 C and quenched in water.
23	20	L	1951	324, 374	<3.0	3a	4.33	0.06	1.37			0.02	0.10	0.005 Ti; water-quenched from 500 C; drawn at 550 C.
24	20	L	1951	343-626	<3.0	4	4.25	0.36	1.59	0.01		0.16	0.02	0.007 Ti; heated at about 300 C.
25	91	C	1951	140-552		24S - T4	4.5		1.5	0.6				As received.
26	91	C	1951	119-731		24S - T4	4.5		1.5	0.6				After heated to 300 C.
27	104	L	1951	15 - 85		Duralumin	4.10	0.42	0.57					94.0 Al; as stamped.
28	36	L	1935	273	1.0		4.0		0.5					Aged at 215 C.
29	36	L	1935	273	1.0		5.0		0.5					Aged at 215 C.
30	36	L	1935	81, 273	1.0		7.0		0.5					Aged at 215 C.

SPECIFICATION TABLE NO. 242 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight per cent) Cu	Fe	Mg	Mn	Ni	Si	Zn	Composition(continued),Specifications and Remarks
31	223	L	1937	298, 473	± 3.0	7543	10.40	1.40	0.29			0.59		Chill-cast.
32	223	L	1937	298, 473	± 3.0	7543	10.4	1.4	0.29			0.59		The above specimen annealed for 2 hrs at 371 C, then cooled to 316 C at 14 C per hr, and then cooled in furnace.
33	223	L	1937	298, 473	± 3.0	7544	3.94	0.63	1.52		2.14	0.55		Chill-cast.
34	223	L	1937	298, 473	± 3.0	7544	3.94	0.63	1.52		2.14	0.55		The above specimen annealed for 2 hrs at 371 C, then cooled to 316 C at 14 C per hr, and then cooled in furnace.
35	223	L	1937	298, 473	± 3.0	7626	4.39	0.73				0.66		Cast in green sand; quenched from high-temperature solution treatment; aged at room temperature.
36	223	L	1937	298, 473	± 3.0	7626	4.39	0.73				0.66		The above specimen annealed for 2 hrs at 371 C, then cooled to 316 C at 14 C per hr, and then cooled in furnace.
37	223	L	1937	298, 473	± 3.0	7640	3.84	0.80	1.29		1.96	0.55		Forged and quenched from high-temperature solution treatment, and then given a low-temperature precipitation treatment.
38	223	L	1937	298, 473	± 3.0	7640	3.84	0.80	1.29		1.96	0.55		The above specimen annealed at 371 C for 2 hrs, cooled to 316 C at 14 C per hr, and cooled in furnace.
39	223	L	1937	298, 473	± 3.0	7643	4.45	0.50		0.76		0.85		Forged and quenched from high-temperature solution treatment, and then given a low-temperature precipitation treatment.
40	223	L	1937	298, 473	± 3.0	7643	4.45	0.50		0.76		0.85		The above specimen annealed at 371 C for 2 hrs, cooled to 316 C at 14 C per hr, and then cooled in furnace.
41	223	L	1937	298, 473	± 3.0	7644	3.79	0.96	0.49	0.59		0.15		Forged and quenched from high-temperature solution treatment.
42	223	L	1937	298, 473	± 3.0	7644	3.7[illegible]	0.96	0.49	0.59		0.15		The above specimen annealed at 371 C for 2 hrs, cooled to 316 C at 14 C per hr, and then cooled in furnace.
43	223	L	1937	298, 473	± 3.0	7678	7.06	1.21				0.75	2.22	Sand-cast.
44	223	L	1937	298, 473	± 3.0	7678	7.06	1.21				0.75	2.22	The above specimen annealed at 371 C for 2 hrs, cooled to 316 C at 14 C per hr, and cooled in furnace.
45	224	L	1923	436		12	7.61	0.56		0.35		0.31		Cast.
46	224	L	1923	447		12	6.78	0.58		0.36		0.23		Cast.
47	224	L	1923	445		12	7.30	0.59		0.41		0.23	0.03	Cast.
48	224	L	1923	428		12	8.04	0.63						Cast.

SPECIFICATION TABLE NO. 242 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Al	Cu	Fe	Mg	Mn	Ni	Si	Zn	Composition (continued), Specifications and Remarks
49	225	L	1928	373-623		'Y' Alloy		4		1.5		2			Annealed for 3 hrs at 300 C.
50	226	L	1951	25-296	<2.0	24S		4.49	0.34	1.47	0.66		0.13	0.01	0.02 Ti, 0.01 Cr; as reported by ALCOA.
51	227	L	1949	293-573		RR 59		2.31	1.23	1.46		1.20	0.88		0.07 Ti; wrought; heated at 525 C for 2 hrs and quenched, and heated at 170 C for 16 hrs and quenched, and again heat-treated at 300 C.
52	227	L	1949	293-473		"Y" Alloy		3.76	0.40	1.33		1.85	0.45		Wrought; heated at 511 C and quenched in fairly hot water, then aged at room temperature.
53	227	L	1949	293-573		"Y" Alloy		3.76	0.40	1.33		1.85	0.45		The above specimen again heat-treated at 300 C.
54	67	L	1932	338,438		3	98.49	1.01	0.209				0.287		Original composition reported as 98.99 Al (containing 0.21 Fe and 0.29 Si); as cast.
55	67	L	1932	338,438		5	94.47	5.06	0.199				0.275		Original composition reported as 94.94 Al (containing 0.21 Fe and 0.29 Si); as cast.
56	67	L	1932	338,438		6	92.34	7.20	0.195				0.269		Original composition reported as 92.80 Al (containing 0.21 Fe and 0.29 Si); as cast.
57	67	L	1932	338,438		8	88.05	11.51	0.186				0.257		Original composition reported as 88.49 Al (containing 0.21 Fe and 0.29 Si); as cast.
58	67	L	1932	338,438		9	79.52	15.46	0.175				0.245		Original composition reported as 84.54 Al (containing 0.21 Fe and 0.29 Si); as cast.
59	67	L	1932	338,438		3A	98.49	1.01	0.209				0.287		Original composition reported as 98.99 Al (containing 0.21 Fe and 0.29 Si); annealed at 500 C.
60	67	L	1932	338,438		5A	94.47	5.06	0.199				0.275		Original composition reported as 94.94 Al (containing 0.21 Fe and 0.29 Si); annealed at 500 C.

SPECIFICATION TABLE NO. 242 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Al	Cu	Fe	Mg	Mn	Ni	Si	Zn	Composition (continued), Specifications and Remarks
61	67	L	1932	338,438		6A	92.34	7.20	0.195				0.269		Original composition reported as 92.80 Al (containing 0.21 Fe and 0.29 Si); annealed at 500 C.
62	67	L	1932	338,438		8A	88.05	11.51	0.186				0.257		Original composition reported as 88.49 Al(containing 0.21 Fe and 0.29 Si); annealed at 500 C.
63	67	L	1932	338,438		9A	84.12	15.46	0.178				0.245		Original composition reported as 84.54 Al(containing 0.21 Fe and 0.29 Si); annealed at 500 C.
64	67	L	1932	338,438		10A	79.52	20.08	0.168				0.232		Original composition reported as 79.92 Al (containing 0.21 Fe and 0.29 Si); annealed at 500 C.
65	67	L	1932	338,438		11A	74.03	25.60	0.156				0.216		Original composition reported as 74.40 Al (containing 0.21 Fe and 0.29 Si); annealed at 500 C.
66	67	L	1932	338,438		12A	69.17	30.46	0.146				0.202		Original composition reported as 69.54 Al (containing 0.21 Fe and 0.29 Si); annealed at 500 C.
67	67	L	1932	338		10	79.52	20.08	0.168				0.232		Original composition reported as 79.92 Al (containing 0.21 Fe and 0.29 Si); as cast.
68	408	E	1925	305.2	<0.5	British L-8		12.21	0.62				0.30		Chill-cast.
69	408	E	1925	307.2	<0.5	British L-8		12.21	0.62				0.30		The above specimen annealed for 30 min at 450 C.
70	408	E	1925	304.2	<0.5	Japanese 2E-8		12.17	0.64		0.98		0.22		Chill-cast.
71	408	E	1925	298.2	<0.5	Japanese 2E-8		12.17	0.64		0.98		0.22		The above specimen annealed for 30 min at 450 C.
72	408	E	1925	302.2	<0.5	F		10.52	0.84			1.04	0.34		3.29 Sn; chill-cast.
73	408	E	1925	304.2	<0.5	F		10.52	0.84			1.04	0.34		3.29 Sn; the above specimen annealed for 30 min at 450 C.
74	408	E	1925	302.2	<0.5	Japanese M-1		8.42	0.70		0.71		0.27		Chill-cast.
75	408	E	1925	296.2	<0.5	Japanese M-1		8.42	0.70		0.71		0.27		The above specimen annealed for 30 min at 450 C.
76	408	E	1925	305.2	<0.5	No. 12		8.07	0.63				0.38		Chill-cast.

SPECIFICATION TABLE NO. 242 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cu	Fe	Mg	Mn	Ni	Si	Zn	Composition (continued), Specifications and Remarks
							Composition (weight per cent)							
77	408	E	1925	302.2	<0.5	No. 12	8.07	0.63				0.38		The preceding specimen annealed for 30 min at 450 C.
78	408	E	1925	299.2	<0.5	No. 12	8.07	0.63				0.38		The above annealed specimen heated for 30 min at 500 C, then quenched in water at about 8 C, and then measured after 4 to 5 hrs.
79	408	E	1925	303.2	<0.5	No. 12	8.07	0.63				0.38		The above quenched specimen measured after aging for 2 weeks.
80	408	E	1925	306.2	<0.5	British 21-11	6.86	0.65				0.32		1.24 Sn; chill-cast.
81	408	E	1925	304.2	<0.5	British 21-11	6.86	0.65				0.32		1.24 Sn; the above specimen annealed for 30 min at 450 C.
82	408	E	1925	302.2	<0.5	D	5.27	0.82	1.15	0.50		0.45		Chill-cast.
83	408	E	1925	299.2	<0.5	D	5.27	0.82	1.15	0.50		0.45		The above specimen annealed for 30 min at 450 C.
84	408	E	1925	298.2	<0.5	D	5.27	0.82	1.15	0.50		0.45		The above annealed specimen heated for 30 min at 490 C, then quenched in water at about 8 C, and then measured after 4 to 5 hrs.
85	408	E	1925	301.2	<0.5	D	5.27	0.82	1.15	0.50		0.45		The above quenched specimen measured after aging for 2 weeks.
86	408	E	1925	308.2	<0.5	D	5.27	0.82	1.15	0.50		0.45		Forged and cold-drawn.
87	408	E	1925	306.2	<0.5	D	5.27	0.82	1.15	0.50		0.45		The above specimen annealed for 30 min at 500 C.
88	408	E	1925	301.2	<0.5	D(zeppelin)	4.32	0.87	0.42	0.55		0.38		Chill-cast.
89	408	E	1925	300.2	<0.5	D(zeppelin)	4.32	0.87	0.42	0.55		0.38		The above specimen annealed for 30 min at 450 C.
90	408	E	1925	303.2	<0.5	D(zeppelin)	4.32	0.87	0.42	0.55		0.38		Forged and cold-drawn.
91	408	E	1925	304.2	0.5	D(zeppelin)	4.32	0.87	0.42	0.55		0.38		The above specimen annealed for 30 min at 500 C.
92	408	E	1925	305.2	0.5	British Y-1	2.53	0.87	0.90		1.75	0.36		Chill-cast.
93	408	E	1925	302.2	<0.5	British Y-1	2.53	0.87	0.90		1.75	0.36		The above specimen annealed for 30 min at 450 C.
94	408	E	1925	299.2	<0.5	British Y-1	2.53	0.87	0.90		1.75	0.36		The above annealed specimen heated for 30 min at 530 C, then quenched in water at about 8 C, and then measured after 4 to 5 hrs.
95	408	E	1925	308.2	<0.5	British Y-1	2.53	0.87	0.90		1.75	0.36		The above quenched specimen measured after aging for 2 weeks.
96	408	E	1925	309.2	<0.5	British Y-2	4.44	0.66	0.86		2.06	0.49		Chill-cast.
97	408	E	1925	311.2	<0.5	British Y-2	4.44	0.66	0.86		2.06	0.49		The above specimen annealed for 30 min at 450 C.
98	408	E	1925	306.2	<0.5	N	1.85	0.95	1.48			0.12		Chill-cast.
99	408	E	1925	301.2	<0.5	N	1.85	0.95	1.48			0.12		The above specimen annealed for 30 min at 450 C.

SPECIFICATION TABLE NO. 212 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Al	Cu	Fe	Mg	Mn	Ni	Si	Zn	Composition (continued), Specifications and Remarks
100	408	E	1925	301.2	<0.5	N		1.85	0.95	1.48			0.12		The preceding annealed specimen heated for 30 min at 500 C, then quenched in water at about 8 C, and then measured after 4 to 5 hrs.
101	408	E	1925	300.2	<0.5	R		1.78	0.92				0.38		0.87 Cr; chill-cast.
102	408	E	1925	294.2	<0.5	R		1.78	0.92				0.38		0.87 Cr; the above specimen annealed for 30 min at 450 C.
103	408	E	1925	306.2	<0.5	X		1.78	0.55	1.56		1.01	0.28		Chill-cast.
104	408	E	1925	299.2	<0.5	X		1.78	0.55	1.56		1.01	0.28		The above specimen annealed for 30 min at 450 C.
105	408	E	1925	303.2	<0.5	X		1.78	0.55	1.56		1.01	0.28		The above annealed specimen heated for 30 min at 500 C, then quenched in water at about 8 C, and then measured after 4 to 5 hrs.
106	525	L	1938	323-623	7.0	1	92.4	4.01	0.22	1.57	0.01	1.94	0.21		Stamped and annealed at 180-210 C for several hrs.
107	525	L	1938	323-623	7.0	2	91.5	4.56	0.25	1.45	0.10	1.84	0.30		Cast and annealed at 180-210 C for several hrs.
108	525	L	1938	323-623	7.0	3	87.71	10.73	0.01	0.30		1.10	0.12	0.03	Trace Co; cast and annealed at 180-210 C for several hrs.
109	526	L	1958	311-645		2014-T6		3.9/ 5.0	1.0 Max	0.2/ 0.8	0.4/ 1.2		0.5/ 1.2	0.25 Max	0.10 Cr, 0.15 (Max) Ti; 0.15 total others; heat treated.
110	524	L	1960	4.0-120		2024-T4		4.58	0.1	1.7	0.1		0.1	0.1	0.1 Ga, 0.1 V, 0.05 Cr, 0.01 Sn, 0.001 Ca, 0.001 Zr, 0.001 Ag, 0.01 Ti; grain-size 0.08 mm x 0.052 mm (longitudinal) and 0.048 mm (transverse).
111	527	L	1935	398,488		RR 53		2.25	1.4	1.6		1.3	1.25		0.1 Ti; as cast.
112	527	L	1935	398,488		RR 53		2.25	1.4	1.6		1.3	1.25		0.1 Ti; annealed at 175 C for 24 hrs.
113	527	L	1935	398,488		RR 53		2.25	1.4	1.6		1.3	1.25		0.1 Ti; annealed at 250 C for 24 hrs.
114	913	L	1965	20-573		Al-2014-T6	92.61	4.57	0.44	0.45	0.93		0.88		0.06 Zn, 0.04 Ti, 0.02 Cr.

SPECIFICATION TABLE NO. 242 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Cu	Fe	Mg	Mn	Ni	Si	Zn	Composition (continued), Specifications and Remarks
115	93	L	1931	87-476	3-4	K-S Alloy special	82.9	15.0	0.6	0.3		0.6	0.6		Nominal composition; cast; electrical conductivity 48.1, 19.3, 15.89 and 12.69 x 10^4 $ohm^{-1}cm^{-1}$ at 87, 273, 373 and 476 K, respectively.
116	913	L	1964	48-573		Al-2219-T81	93.12	5.91	.21	0.01	0.28		0.13	0.05	0.01 Cr, 0.02 Ti, 0.10 V, 0.16 Zr.

DATA TABLE NO. 242 THERMAL CONDUCTIVITY OF [ALUMINUM + COPPER + ΣX_i] ALLOYS

($Al + Cu < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
353.00	1.590
423.00	1.632
473.00	1.674
523.00	1.715
CURVE 2*	
353.00	1.590
423.00	1.632
473.00	1.632
CURVE 3	
353.00	1.674
423.00	1.674
473.00	1.715
CURVE 4	
353.00	1.715
423.00	1.715
473.00	1.757
523.00	1.757
CURVE 5	
353.00	1.757
423.00	1.757
473.00	1.799
CURVE 6*	
353.00	1.590
423.00	1.632
473.00	1.632
CURVE 7*	
353.00	1.632
423.00	1.715
473.00	1.757
CURVE 8	
353.00	1.464
423.00	1.506
473.00	1.548
CURVE 9*	
353.00	1.674
423.00	1.674
473.00	1.674
CURVE 10*	
353.00	1.674
423.00	1.715
473.00	1.757
CURVE 11	
353.00	1.590
423.00	1.590
473.00	1.632
CURVE 12*	
353.00	1.715
423.00	1.674
473.00	1.632
CURVE 13*	
353.00	1.674
423.00	1.674
473.00	1.715
CURVE 14*	
353.00	1.632
423.00	1.715
473.00	1.757
CURVE 15	
353.00	1.715*
423.00	1.757*
473.00	1.799*
523.00	1.799
573.00	1.841
CURVE 16	
3.28	0.0490
3.90	0.0619
4.22	0.0703
CURVE 16 (cont.)	
5.20	0.0879
5.95	0.0971
6.22	0.116
8.0	0.137
10.4	0.172
12.4	0.209
16.2	0.259
19.4	0.293
22.0	0.305
24.5	0.377
30.5	0.464
39.0	0.586
50.5	0.749
63.5	0.837
81.0	0.879
CURVE 17	
87.00	1.117
273.00	1.623
373.00	1.711*
476.00	1.778*
CURVE 18	
87.00	1.381
273.00	1.527
373.00	1.640
476.00	1.803
CURVE 19	
87.00	1.318
273.00	1.602
373.00	1.715
476.00	1.867
CURVE 20	
87.00	0.887
273.00	1.603
373.00	1.808
476.00	1.946
CURVE 21	
380.20	1.962
472.20	1.996
575.20	2.050
CURVE 22	
324.20	1.452
374.20	1.561
424.20	1.619
475.20	1.799
526.20	1.956
CURVE 23	
324.20	1.870
374.20	1.891
CURVE 24*	
343.20	1.657
415.20	1.724
458.20	1.749
475.20	1.757
512.20	1.824
536.20	1.833
565.20	1.862
626.20	1.841
CURVE 25	
140.80	0.854
172.90	0.912
202.50	1.008
227.40	1.109
229.30	1.109
241.10	1.125
254.70	1.125
267.90	1.205
349.00	1.318
354.00	1.347
361.80	1.360
366.90	1.393
367.80	1.389
374.50	1.351
381.70	1.339
383.60	1.377
387.10	1.372
CURVE 25 (cont.)	
391.50	1.427
392.10	1.423
393.70	1.410
395.50	1.389
400.40	1.385
402.20	1.423
408.30	1.423
414.10	1.448
414.70	1.381
417.00	1.402
417.40	1.406
426.20	1.473
427.50	1.435
434.60	1.485
435.80	1.469
437.40	1.481
439.90	1.556
451.40	1.607
455.40	1.596
456.80	1.540
457.40	1.699
458.60	1.703
458.80	1.548
460.30	1.724*
473.00	1.745*
480.60	1.766*
482.30	1.732*
489.80	1.732*
507.70	1.774*
521.30	1.791*
551.90	1.845*
CURVE 26	
119.20	1.485
147.80	1.544
175.00	1.648
201.40	1.644
220.20	1.686
232.50	1.711
244.30	1.816
256.20	1.699
358.20	1.812
370.40	1.950
382.90	1.745
396.00	1.782
396.60	1.912
CURVE 26 (cont.)	
413.10	1.900
429.60	1.887
446.40	1.854
510.20	1.933
543.90	1.946
569.60	1.879
578.30	1.858
589.90	1.879
612.20	1.891
613.70	1.837
634.90	1.866
656.20	1.761
681.70	1.732
702.00	1.745
730.60	1.690
CURVE 27	
15.83	0.240
17.04	0.263
17.91	0.272
19.79	0.294
20.61	0.302
75.70	0.909
84.10	0.971
CURVE 28	
273.20	1.992
CURVE 29	
273.20	1.925
CURVE 30	
81.20	1.837
273.20	1.854
CURVE 31*	
298.20	1.431
473.20	1.602
CURVE 32*	
298.20	1.757
473.20	1.799
CURVE 33*	
298.20	1.439
473.20	1.577
CURVE 34*	
298.20	1.662
473.20	1.766
CURVE 35*	
298.20	1.448
473.20	1.678
CURVE 36*	
298.20	1.891
473.20	1.925
CURVE 37*	
298.20	1.473
473.20	1.732
CURVE 38*	
298.20	1.866
473.20	1.908
CURVE 39*	
298.20	1.548
473.20	1.787
CURVE 40	
298.20	1.975
473.20	2.025
CURVE 41*	
298.20	1.469
473.20	1.720
CURVE 42*	
298.20	1.791
473.20	1.883
CURVE 43*	
298.20	1.410
473.20	1.582
CURVE 44*	
298.20	1.703
473.20	1.782
CURVE 45	
436.20	1.381
CURVE 46	
446.70	1.423
CURVE 47	
445.20	1.381
CURVE 48*	
427.70	1.464
CURVE 49*	
373.20	1.569
523.20	1.569
623.20	1.590
CURVE 50	
25.43	0.226
37.24	0.335
50.26	0.427
62.28	0.506
77.28	0.586
96.41	0.661
111.40	0.720
126.16	0.774
136.01	0.824
141.17	0.823

*Not shown on plot

DATA TABLE NO. 242 (continued)

T	k
CURVE 50 (cont.)	
157.1	0.904
171.0	0.937
189.0	1.00
212.1	1.05
230.3	1.09
248.1	1.14
267.5	1.19
286.1	1.22
296.1	1.24
CURVE 51*	
293.2	1.69
373.2	1.75
473.2	1.82
573.2	1.84
CURVE 52*	
293.2	1.35
373.2	1.50
473.2	1.74
CURVE 53*	
293.2	1.82
373.2	1.88
473.2	1.94
573.2	1.94
CURVE 54*	
338.2	1.81
438.2	2.10
CURVE 55*	
338.2	1.63
438.2	1.88
CURVE 56*	
338.2	1.69
438.2	1.81
CURVE 57	
338.2	1.51
438.2	1.69
CURVE 58	
338.2	1.51
438.2	1.56
CURVE 59	
338.2	2.05
438.2	2.13
CURVE 60*	
338.2	1.93
438.2	1.97
CURVE 61*	
338.2	1.89
438.2	1.94
CURVE 62	
338.2	1.84
438.2	1.86
CURVE 63*	
338.2	1.82
438.2	1.75
CURVE 64*	
338.2	1.74
438.2	1.76
CURVE 65*	
338.2	1.64
438.2	1.69
CURVE 66*	
338.2	1.62
438.2	1.59
CURVE 67	
338.2	1.44
CURVE 68	
305.2	1.23
CURVE 69	
307.2	1.45
CURVE 70	
304.2	0.933
CURVE 71	
298.2	1.33
CURVE 72*	
302.2	1.34
CURVE 73*	
304.2	1.59
CURVE 74	
302.2	1.02
CURVE 75	
296.2	1.35
CURVE 76*	
305.2	1.39
CURVE 77*	
302.2	1.67
CURVE 78*	
299.2	1.32
CURVE 79*	
303.2	1.32
CURVE 80	
306.2	1.47
CURVE 81	
304.2	1.65
CURVE 82*	
302.2	1.18
CURVE 83	
299.2	1.51
CURVE 84*	
298.2	1.23
CURVE 85*	
301.2	1.22
CURVE 86	
308.2	1.36
CURVE 87*	
306.2	1.59
CURVE 88*	
301.2	1.22
CURVE 89*	
300.2	1.52
CURVE 90*	
303.2	1.48
CURVE 91*	
304.2	1.73
CURVE 92*	
305.2	1.44
CURVE 93*	
302.2	1.63
CURVE 94	
299.2	1.38
CURVE 95	
308.2	1.32
CURVE 96*	
309.2	1.29
CURVE 97*	
311.2	1.46
CURVE 98*	
306.2	1.57
CURVE 99*	
301.2	1.65
CURVE 100*	
301.2	1.59
CURVE 101	
300.2	1.04
CURVE 102	
294.2	1.09
CURVE 103	
306.2	1.47
CURVE 104	
299.2	1.64
CURVE 105*	
303.2	1.45
CURVE 106*	
323.2	1.59
373.2	1.72
423.2	1.76
473.2	1.80
523.2	1.80
573.2	1.84
623.2	1.88
CURVE 107*	
323.2	1.46
373.2	1.51
423.2	1.55
473.2	1.59
523.2	1.59
573.2	1.63
623.2	1.63
CURVE 108*	
323.2	1.63
373.2	1.72
423.2	1.76
473.2	1.80
523.2	1.80
573.2	1.84
623.2	1.88
CURVE 109*	
311.0	1.54
333.2	1.55
422.2	1.64
519.5	1.68
616.8	1.73
644.6	1.74
CURVE 110	
4	0.0315
6	0.0489
8	0.0661
10	0.0832
14	0.117
20	0.170
24	0.203
30	0.249
40	0.322
50	0.390
60	0.452
70	0.508
80	0.557
100	0.645
120	0.727
CURVE 111*	
398.2	1.32
488.2	1.44
CURVE 112*	
398.2	1.37
488.2	1.38
CURVE 113*	
398.2	1.39
488.2	1.41
CURVE 114	
20.2	0.50
48.2	0.82
73.2	0.96
98.2	1.07
123.2	1.16
148.2	1.25
173.2	1.32
198.2	1.35
223.2	1.45
248.2	1.50
273.2	1.56
323.2	1.66
373.2	1.74
423.1	1.81
CURVE 114 (cont.)	
473.2	1.88
523.2	1.94
573.2	1.98
CURVE 115*	
87.0	1.138
273.0	1.393
373.0	1.502
476.0	1.590
CURVE 116*	
48.2	0.44
73.2	0.56
98.2	0.71
123.2	0.77
148.2	0.85
173.2	0.93
198.2	1.00
223.2	1.07
248.2	1.13
273.2	1.17
323.2	1.28
373.2	1.33
423.1	1.39
473.2	1.44
523.2	1.49
573.2	1.54

*Not shown on plot

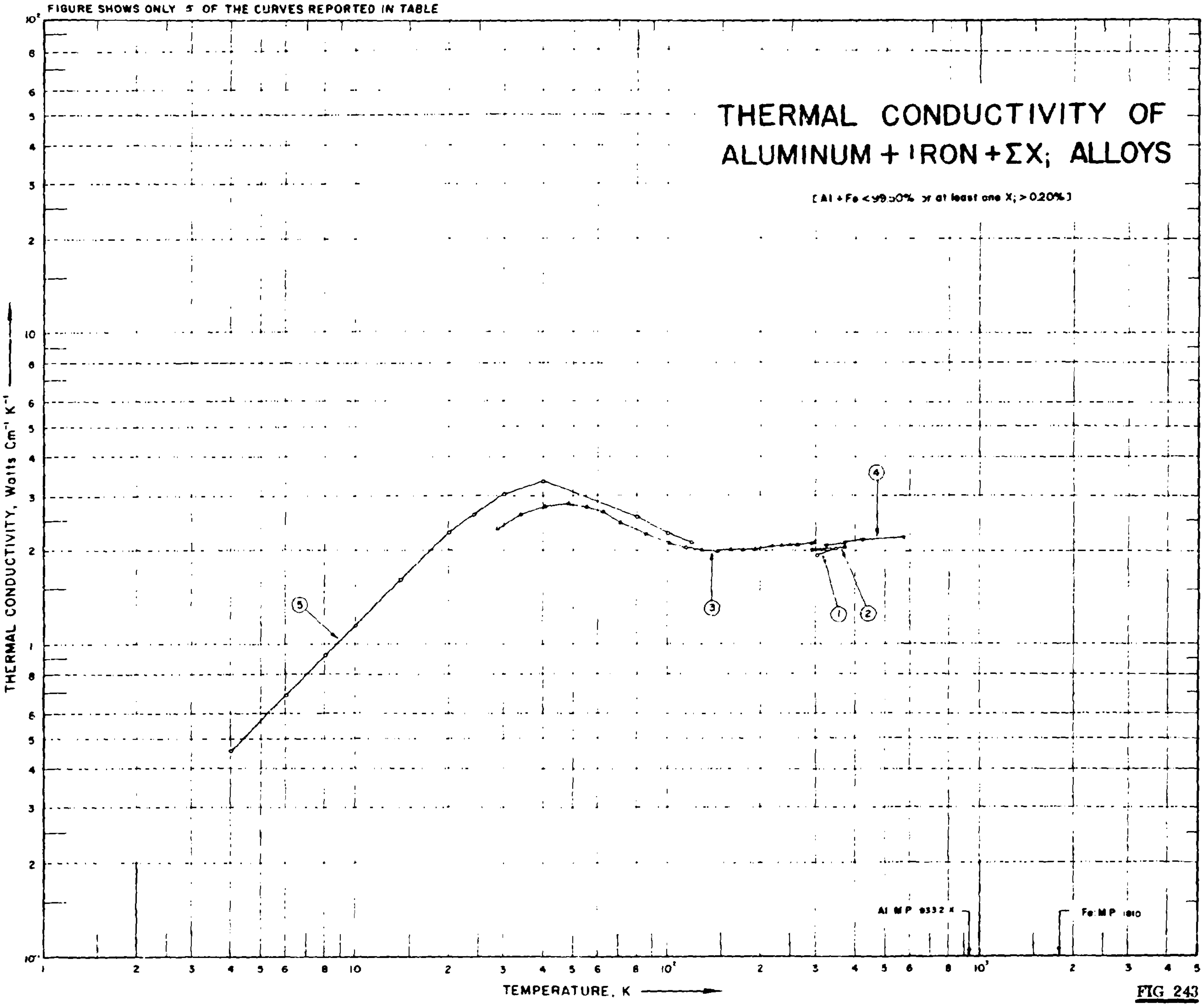


FIGURE SHOWS ONLY 5 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF ALUMINUM + IRON + ΣX; ALLOYS
[Al + Fe < 99.50% or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Al M.P. 933.2 K
Fe M.P. 1810

FIG 243

SPECIFICATION TABLE NO. 243 THERMAL CONDUCTIVITY OF [ALUMINUM + IRON + ΣX_i] ALLOYS

(Al + Fe $\geq$ 99.50% or at least one X_i $\leq$ 0.20%)

[For Data Reported in Figure and Table No. 243]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Fe	Cr	Cu	Mg	Mn	Si	Ti	Composition (continued), Specifications and Remarks
1	493	L	1922	302, 347	±1.5	Al	98.87	0.75					0.38		
2	77	E	1900	291, 373			99.7	0.7		0.4					
3	226	L	1951	29-297	<2.0	J 51	98.17	0.56	0.03	0.29	0.56	0.02	0.38	0.01	
4	528		1953	323-573		Cond-Al	Bal	0.43			0.32		0.10		Cast, hot-rolled above 750 F, annealed at 840 F for 4 hrs, cold-rolled by a 10% reduction, and then aged at 390 F for 5 hrs.
5	524	L	1960	4.0-120		1100-0	Bal	0.41	0.01	0.1	0.1	0.1	0.22	0.01	0.1 Ga, 0.01 Pb, 0.01 V, 0.001 Ca, 0.001 Zr, 0.0001 Bi, 0.01 Zn; average grain size 0.040 mm x 0.032 mm (longitudinal) x 0.036 mm (transverse).
6	224	L	1923	410.2		Al-1	99.49	0.3		0.07			0.3		0.07 Zn; hard-drawn.

DATA TABLE NO. 243 THERMAL CONDUCTIVITY OF [ALUMINUM + IRON + ΣX$_i$] ALLOYS

(Al + Fe ≥ 99.50% or at least one X$_i$ > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k	T	k
CURVE 1		CURVE 5	
301.8	1.94	4	0.459
347.2	2.04	6	0.688
		8	0.918
CURVE 2		10	1.145
		14	1.61
291.2	2.010	20	2.28
373.2	2.060	24	2.62
		30	3.04
CURVE 3		40	3.32
		80	2.57
28.66	2.351	100	2.27
33.72	2.607	120	2.12
40.46	2.774		
48.22	2.812	CURVE 6*	
55.09	2.753		
62.02	2.661	410.2	1.966
70.48	2.469		
85.51	2.264		
102.26	2.105		
115.15	2.050		
129.51	2.004		
145.09	1.996		
160.18	[illegible]		
175.17	[illegible]		
190.17	2.017		
218.55	2.063		
233.05	2.067		
248.07	2.084		
262.05	2.092		
290.98	2.117		
296.96	2.125		
CURVE 4			
323.2	2.09		
373.2	2.13		
423.2	2.17		
573.2	2.21		

*Not shown on plot

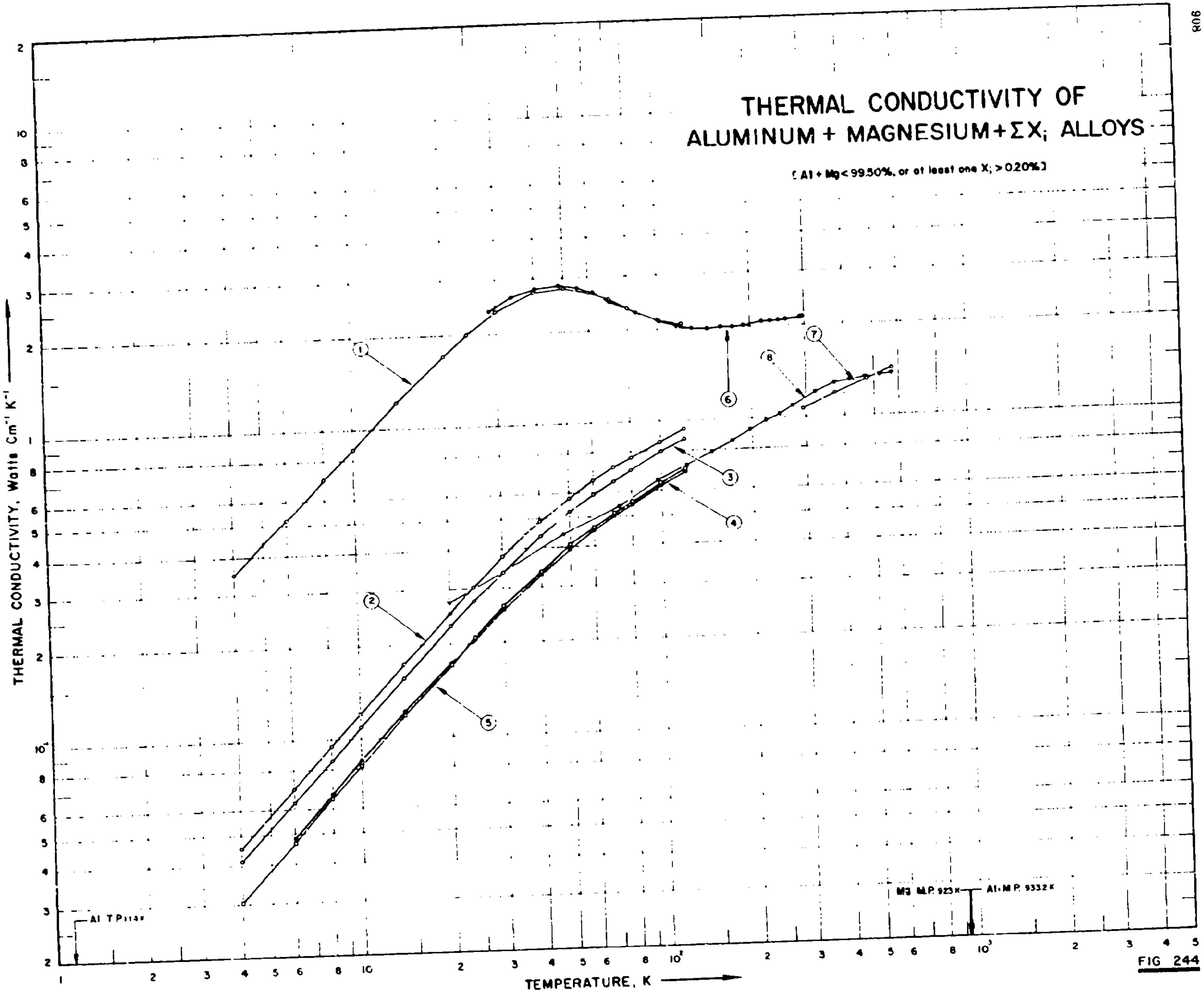

THERMAL CONDUCTIVITY OF
ALUMINUM + MAGNESIUM + ΣX; ALLOYS
[Al + Mg < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Al T.P. 113 K
Mg M.P. 923 K
Al: M.P. 933.2 K
1
2
3
4
5
6
7
8

FIG 244

SPECIFICATION TABLE NO. 244 THERMAL CONDUCTIVITY OF ALUMINUM + MAGNESIUM + ΣX_i] ALLOYS

(Al + Mg 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 244]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Al	Mg	Cr	Cu	Fe	Mn	Si	Ti	Zn	Composition (continued), Specifications and Remarks
							Composition (weight percent)									
1	524	L	1960	4-120		6063-T5	Bal	0.65	0.01	0.01	0.1	0.1	0.38	0.01	0.01	0.1 Ga, 0.01 V, 0.001 Ca, 0.001 Pb; grain size 0.052 mm x 0.048 mm (longitudinal) and 0.052 mm (transverse); precipitation heat-treated.
2	524	L	1960	4-120		5052-O	Bal	2.46	0.22	0.1	0.1	0.1	0.1	0.01	0.1	0.1 Ga, 0.01 V, 0.001 Ca, 0.001 Zr; grain size 0.056 mm x 0.032 mm (longitudinal) and 0.040 mm (transverse); annealed in vacuum for 1 hr at 350 C.
3	524	L	1960	4-120		5154-O	Bal	3.32	0.21	0.1	0.1	0.1	0.1	0.01	0.01	0.01 V, 0.01 Zr, 0.001 Ca, 0.001 Pb; grain size 0.036 mm x 0.028 mm (longitudinal) and 0.032 mm (transverse); annealed in vacuum for 1 hr at 350 C.
4	524	L	1960	6-120		5083-O	Bal	4.44	0.1	0.04	0.1	0.7	0.1			Average crystal grain size 0.74 mm x 0.21 mm (longitudinal) and 0.54 mm x 0.14 mm (transverse); annealed in vacuum for 1 hr at 350 C.
5	524	L	1960	4-120		5086-F	Bal	4.20	0.1	0.07	0.28	0.51	0.1	0.02	0.1	Average crystal grain size 0.061 mm x 0.022 mm (longitudinal) and 0.086 mm x 0.020 mm (transverse).
6	226	L	1951	29-297	< 2.0	J 51	98.17	0.56	0.01	0.29	0.56	0.02	0.38	0.01		
7	227	L	1949	293-573		RR 131D	94.87	1.30	0.18	0.30	0.30	0.44	0.50	0.12	0.45	1.20 Ni, 0.25 Co; cast; heated for 10 hrs at 160-170 C and cooled in air.
8	913	L	1964	20-573		Al 5456-H343	92.87	5.1	0.13	0.10		0.8		0.20	0.25	0.40 Fe and Si, 0.15 others.

DATA TABLE NO. 244 THERMAL CONDUCTIVITY OF [ALUMINUM + MAGNESIUM + ΣX_i] ALLOYS

($Al + Mg < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
4	0.351
6	0.522
8.	0.697
10	0.868
14	1.215
20	1.70
24	2.00
30	2.35
40	2.68
50	2.76
60	2.67
70	2.52
80	2.34
100	2.13
120	2.06
CURVE 2	
4	0.0452
6	0.0698
8	0.0952
10	0.121
14	0.174
20	0.250
24	0.304
30	0.379
40	0.487
50	0.578
60	0.719
70	0.719
80	0.768
100	0.859
120	0.939
CURVE 3	
4	0.0412
6	0.0630
8	0.0857
10	0.109
14	0.156
20	0.228
24	0.272
30	0.337
CURVE 3 (cont.)	
50	0.521
60	0.591
70	0.649
80	0.699
100	0.790
120	0.872
CURVE 4	
6	0.0486
8	0.0669
10	0.0852
14	0.122
20	0.173
24	0.206
30	0.254
40	0.332
50	0.395
60	0.451
70	0.501
80	0.546
100	0.627
120	0.683
CURVE 5	
4	0.0302
6	0.0469
8	0.0644
10	0.0820
14	0.118
20	0.172
24	0.208
30	0.261
40	0.337
50	0.407
60	0.462
70	0.513
80	0.559
100	0.635
120	0.698
CURVE 6	
28.66	2.351
33.72	2.607
40.46	2.774
84.22	2.812
55.09	2.753
62.02	2.661
70.48	2.469
85.51	2.264
102.26	2.105
115.15	2.050
129.51	2.004
145.09	1.996
160.18	2.004
175.17	2.004
190.17	2.004
190.17	2.017
218.55	2.063
233.05	2.067
248.07	2.084
262.05	2.092
290.98	2.117
296.96	2.125
CURVE 7	
293.2	1.067
373.2	1.192
473.2	1.318
573.2	1.423
CURVE 8	
20.2	0.27
48.2	0.44
73.2	0.54
98.2	0.65
123.2	0.72
148.2	0.79
173.2	0.85
198.2	0.92
223.2	0.98
248.2	1.03
273.2	1.09
323.2	1.20
CURVE 8 (cont.)	
373.2	1.28
423.1	1.31
473.2	1.32
523.2	1.35
573.2	1.36

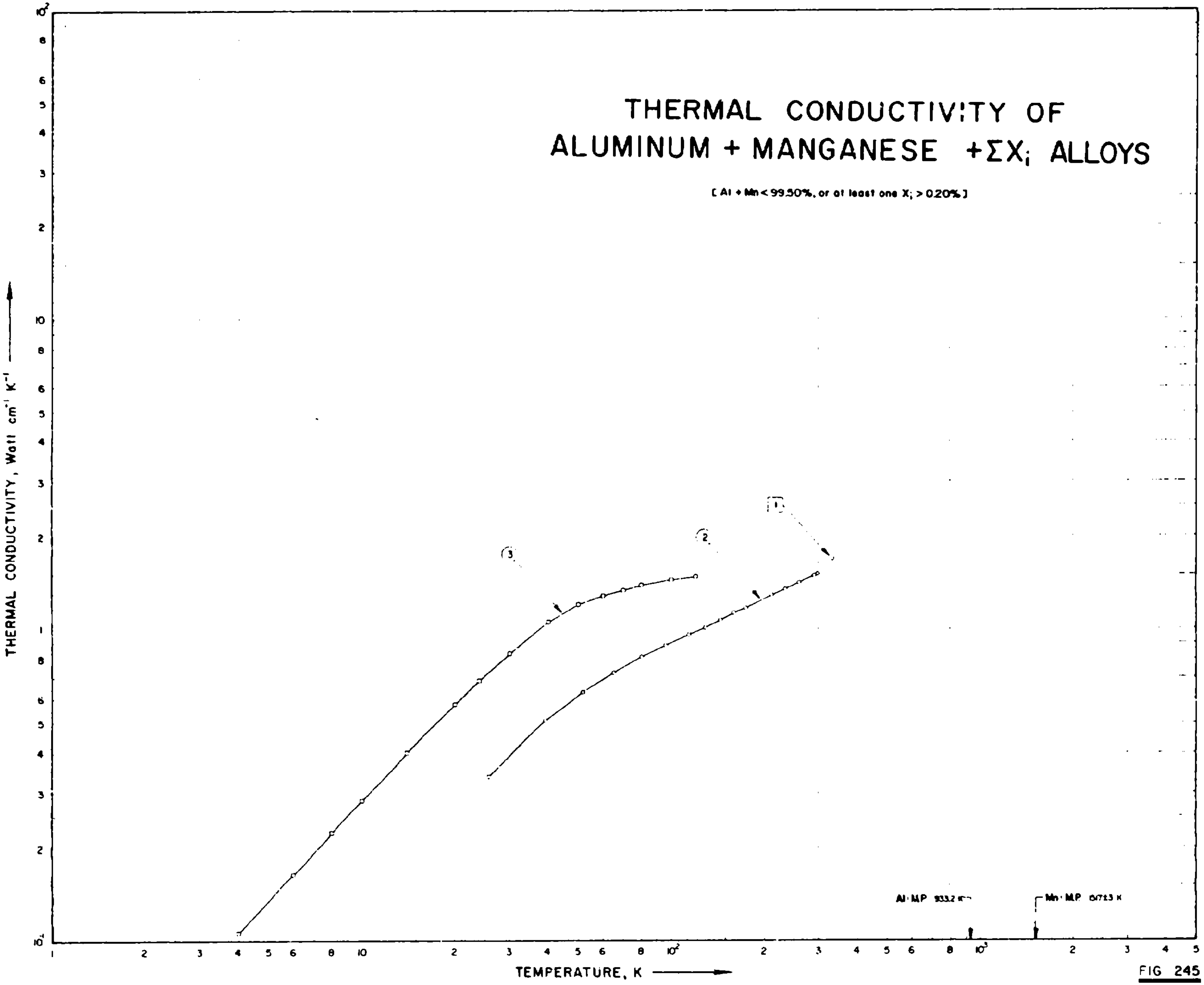

THERMAL CONDUCTIVITY OF
ALUMINUM + MANGANESE +ΣX_i ALLOYS
[Al + Mn < 99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Al: M.P. 933.2 K
Mn: M.P. 1517±3 K
1
2
3

FIG 245

SPECIFICATION TABLE NO. 245 THERMAL CONDUCTIVITY OF [ALUMINUM + MANGANESE + ΣX_i] ALLOYS

(Al + Mn < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 245]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mn	Fe	Cu	Si	Cu	Mg	Composition (continued), Specifications and Remarks
1	230	L	1925	336.2			1.07	0.66	0.48	0.27			Specimen ~6 cm long with cross-section 0.3 cm²; supplied by Aluminum Co. of America; electrical conductivity 23.30 x 10^4 ohm^{-1} cm^{-1} at 23 C.
2	226	L	1951	26-300	< 2	3004	1.2	0.52	0.16	0.13	0.02	1.02	0.02 Ti.
3	524	L	1960	4.0-120		3003-F	1.23	0.48	0.1	0.15	0.02	0.1	0.1 Ga, 0.01 each Ca, Ti, V and Zn, 0.001 each Bi, Pb and Zr; specimen drawn to 3.66 mm in dia; supplied by Aluminum Co. of America; in "as fabricated" condition; average grain size 0.016 x 0.008 mm in longitudinal and 0.012 mm in the transverse directions.

DATA TABLE NO. 245 THERMAL CONDUCTIVITY OF [ALUMINUM + MANGANESE + ΣX_i] ALLOYS

(Al + Mn < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
336.0	1.695
CURVE 2	
25.74	0.339
39.17	0.510
51.91	0.628
65.18	0.724
80.22	0.812
96.02	0.883
114.88	0.958
129.98	1.013
145.04	1.067
160.04	1.125
174.96	1.167
212.26	1.280
234.93	1.343
260.22	1.406
291.44	1.477
299.87	1.490
CURVE 3	
4	0.107
6	0.163
8	0.222
10	0.282
14	0.402
20	0.575
24	0.682
30	0.833
40	1.06
50	1.20
60	1.28
70	1.33
80	1.38
100	1.44
120	1.47

FIGURE SHOWS ONLY 9 OF THE CURVES REPORTED IN TABLE

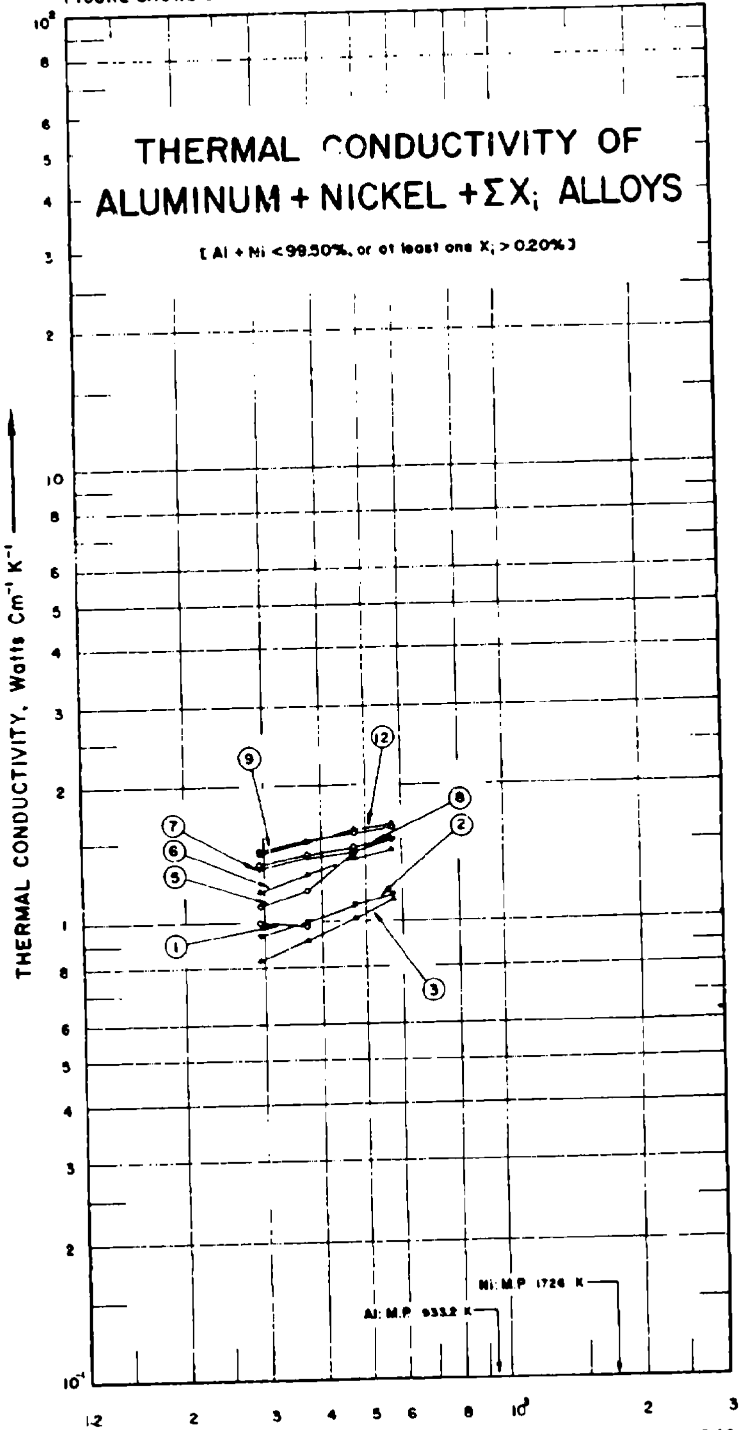


FIG 246

SPECIFICATION TABLE NO. 246 THERMAL CONDUCTIVITY OF [ALUMINUM + NICKEL + ΣX_i] ALLOYS

($Al + Ni < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 246]

Curve No.	Ref No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Cr	Cu	Fe	Mg	Mn	Si	Ti	Composition (continued), Specifications and Remarks
1	227	L	1949	293, 373		RAE 40 C	5.0	0.5	2.0	0.5	0.5	3.0	0.3		0.4 Be, sand-cast; heated 6 hrs at 570 ± 5 C and quenched in cold water, and then heated 20 hrs at 150 C and cooled in air.
2	227	L	1949	293-573		RAE 40 C	5.0	0.5	2.0	0.5	0.5	3.0	0.3		0.4 Be; the above specimen again heated at 300 C.
3	227	L	1949	293-573		RAE 47 ~~B~~ D	4.0		1.0	0.5	0.5	3.0	0.2	0.2	Sand-cast; heated at 300 C.
4	227	L	1949	293-573		RAE 47 ~~B~~ D	4.0		1.0	0.5	0.5	3.0	0.2	0.2	Chill-cast; heated at 300 C.
5	227	L	1949	293-473		RAE 55	2.90	0.15	1.89	0.43	0.56	1.55	0.21	0.07	Chill-cast; heated in solution 4 hrs at 570 C and quenched in boiling water, and then heated 12 hrs at 260 C and cooled in air.
6	227	L	1949	293-573		RAE 55	2.90	0.15	1.89	0.43	0.56	1.55	0.21	0.07	The above specimen again heat-treated at 300 C.
7	227	L	1949	293-573		RAE 55	2.90	0.15	1.89	0.43	0.56	1.55	0.21	0.07	The above specimen again heat-treated at 400 C.
8	227	L	1949	293-573		RAE 40 C	5.0	0.5	2.0	0.5	0.5	3.0	0.3		Wrought, heated 6 hrs at 570 ± 5 C and quenched in cold water, then heated 20 hrs at 150 C and cooled in air, and again heat-treated at 300 C.
9	227	L	1949	293-573		RAE 47 D	4.0		1.0	0.5	0.5	3.0	0.3		0.4 Be; wrought; heated 6 hrs at 570 ± 5 C and quenched in cold water, then heated 20 hrs at 160 C and cooled in air, and again heat-treated at 300 C.
10	227	L	1949	293-473		RAE 55(Bar 33 A)	2.85	0.49	1.67	0.41		2.02	0.17	0.07	Wrought, heated in solution 4 hrs at 570 C and quenched in boiling water, and then aged 40 hrs at 160 C and cooled in air.
11	227	L	1949	293-573		RAE 55(Bar 33 A)	2.85	0.49	1.67	0.41		2.02	0.17	0.07	The above specimen again heat-treated at 300 C.
12	237	L	1949	293-573		RAE 55(Bar 39 A)	3.01	0.17	1.68	0.40	0.49	1.41	0.15	0.03	Wrought; heated in solution 4 hrs at 570 C and quenched in boiling water, then aged 40 hrs at 160 C and cooled in air, and again heat-treated at 300 C.

DATA TABLE NO. 246 THERMAL CONDUCTIVITY OF [ALUMINUM + NICKEL + ΣX_i] ALLOYS

($Al + Ni < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k
CURVE 1	
293.20	1.004
373.20	0.983
CURVE 2	
293.20	0.941
373.20	1.004
473.20	1.088
573.20	1.151
CURVE 3	
293.20	0.837
373.20	0.920
473.20	1.025
573.20	1.130
CURVE 4*	
293.20	0.837
273.20	0.941
473.20	1.025
573.20	1.109
CURVE 5	
293.20	1.088
373.20	1.172
473.20	1.423
CURVE 6	
293.20	1.172
373.20	1.276
473.20	1.381
573.20	1.443
CURVE 7	
293.20	1.318
373.20	1.381
473.20	1.423
573.20	1.506

T	k
CURVE 8	
293.20	1.339
373.20	1.402
473.20	1.464
573.20	1.506
CURVE 9	
293.20	1.443
373.20	1.506
473.20	1.569
573.20	1.611
CURVE 10*	
293.20	1.172
373.20	1.297
473.20	1.423
CURVE 11*	
293.20	1.297
373.20	1.381
473.20	1.464
573.20	1.548
CURVE 12	
293.20	1.423
373.20	1.506
473.20	1.590
573.20	1.632

*Not shown on plot

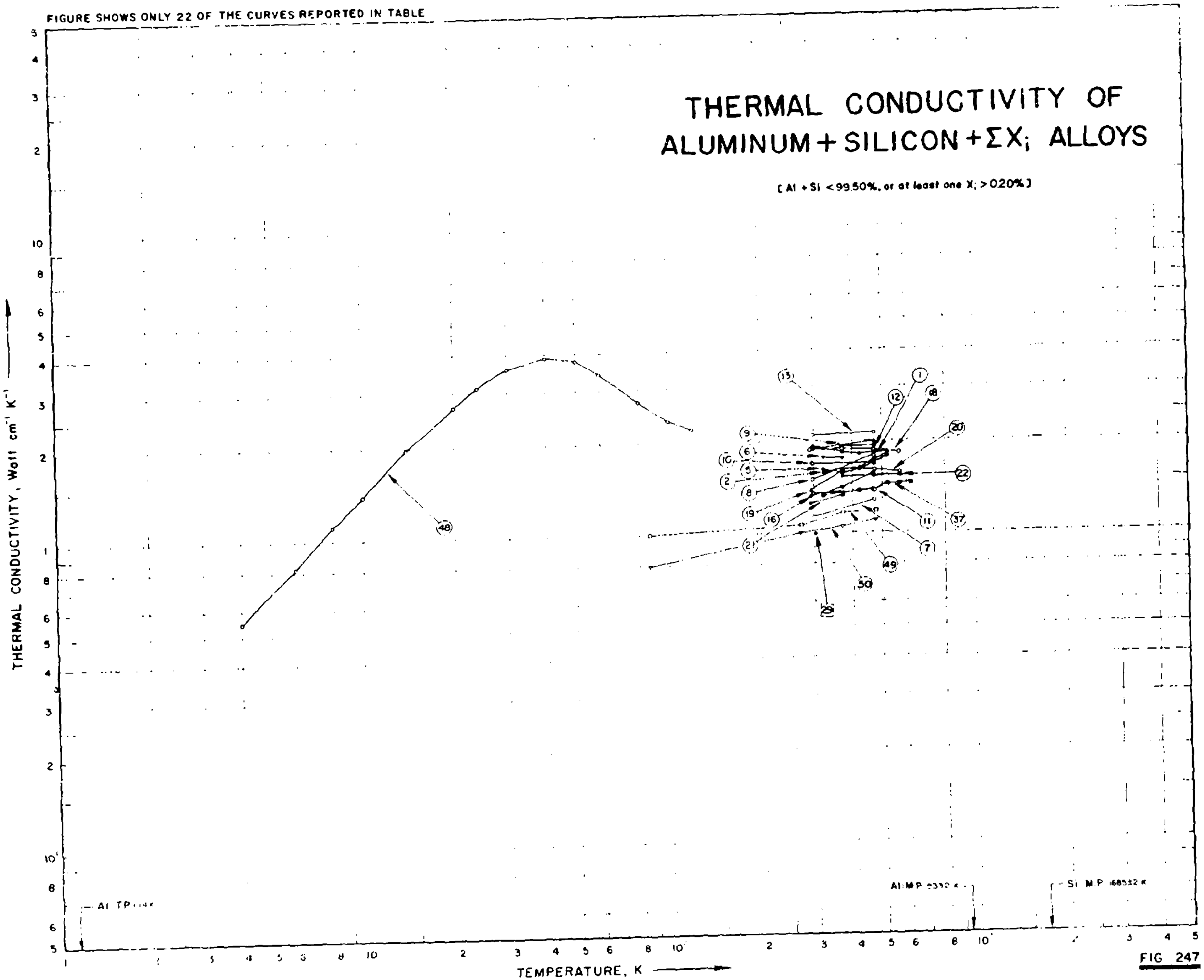


FIGURE SHOWS ONLY 22 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
ALUMINUM + SILICON + ΣX; ALLOYS
[Al + Si < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Al T.P.
Al M.P.
Si M.P.

FIG 247

SPECIFICATION TABLE NO. 247 THERMAL CONDUCTIVITY OF [ALUMINUM + SILICON + ΣX_i] ALLOYS

(Al + Si < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 247]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Si	Cu	Fe	Mg	Mn	Ni	Ti	Zn	Composition (continued), Specifications and Remarks
							Composition (weight per cent)								
1	20	L	1951	324-523	<3.0	5	5.5	1.43	0.41	0.42	0.27		0.04	0.14	Annealed at 300 - 500 C; molten metal not fluxed with gases.
2	20	L	1951	325-524	<3.0	6	5.5	1.43	0.41	0.42	0.27		0.04	0.14	Water-quenched from 520 C; molten metal not fluxed with gases.
3	20	L	1951	373	<3.0	6a	5.5	1.43	0.41	0.42	0.27		0.04	0.14	Water-quenched from 520 C, then drawn at 550 C; molten metal not fluxed with gases.
4	20	L	1951	373-426	<3.0	7	5.5	1.43	0.41	0.42	0.27		0.04	0.14	Annealed at 300 - 500 C; molten metal strongly fluxed with gases.
5	20	L	1951	323-523	<3.0	8	5.5	1.43	0.41	0.42	0.27		0.04	0.14	Water-quenched from 520 C; molten metal strongly fluxed with gases.
6	20	L	1951	323-373	<3.0	8a	5.5	1.43	0.41	0.42	0.27		0.04	0.14	Water-quenched from 520 C, then drawn at 550 C; molten metal strongly fluxed with gases.
7	223	L	1937	298, 473	±4.0	7542	13.8	0.75	1.09	1.18		2.45			Chill-cast.
8	223	L	1937	298, 473	±4.0	7628	5.04	0.95	0.36	0.34					Cast, solution-treated, and aged.
9	223	L	1937	298, 473	±4.0	7642	0.91	0.5	0.58	0.5					Forged, solution-treated, and precipitation-treated.
10	223	L	1937	298, 473	±4.0	7679	11.78	0.84	0.76	1.06		0.92			Forged, solution-treated, and precipitation-treated.
11	223	L	1937	298, 473	±4.0	7542a	13.8	0.75	1.09	1.18		2.45			Annealed at 700 F.
12	223	L	1937	298, 473	±4.0	7628a	5.04	0.95	0.36	0.34					Annealed at 700 F.
13	223	L	1937	298, 473	±4.0	7642a	0.91	0.5	0.58	0.5					Annealed at 700 F.
14	223	L	1937	298, 473	±4.0	7679a	11.78	0.84	0.76	1.06		0.92			Annealed at 700 F.
15	227	L	1949	293-573		RR50	2.25	1.40	1.18	0.12		0.90	0.19		Cast; heated 10 hrs at 160 - 170 C and air-cooled, and then heat-treated at 300 C.
16	227	L	1949	293-473		RR53c	2.42	1.33	1.12	0.50		0.87	0.15		Cast; heated 2 hrs at 530 C and water-quenched, and again heated 15 hrs at 160 - 170 C.
17	227	L	1949	293-573		RR53c	2.42	1.33	1.12	0.50		0.87	0.15		The above specimen again heat-treated at 300 C.
18	227	L	1949	293-573		Alpax Gamma	12.0		0.28	0.35	0.29				Cast; heated 4 hrs at 510 - 518 C and quenched in cold water and then heated 16 hrs at 150 - 165 C, and again heat-treated at 300 C.
19	227	L	1949	293, 373	±7%	SA 1	11.0	5.0	0.5	0.6			0.05		0.2 Co; chill-cast; heated 3 hrs at 495 - 500 C and quenched in cold water, and then aged 16 hrs at 165 C and air-cooled.
20	227	L	1949	293-573	±7%	SA 1	11.0	5.0	0.5	0.6			0.05		0.2 Co; the above specimen again heat-treated at 300 C.
21	227	L	1949	293, 373	±4%	SA 44	11.0	5.0	0.5	0.5	0.4		0.1		0.3 Co; chill-cast; heated 3 hrs at 495 - 500 C and quenched in cold water and then aged 16 hrs at 165 C and air-cooled.

SPECIFICATION TABLE NO. 247 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight per cent) Si	Cu	Fe	Mg	Mn	Ni	Ti	Zn	Composition (continued), Specifications and Remarks
22	227	L	1949	293-573	±4%	SA 44	11.0	5.0	0.5	0.5	0.4		0.1		0.3 Co; the above specimen again heat-treated at 300 C.
23	227	L	1949	293-473		Lo Ex	11.80	1.03	0.50	0.91	0.03	1.02	0.02		Wrought; heated 12 hrs at 522 C and aged 4 hrs at 135 C and cooled in air, and again aged at 200 C and cooled in air.
24	227	L	1949	293-473		Lo Ex	11.80	1.03	0.50	0.90	0.03	1.02	0.02		Wrought; heated 12 hrs at 522 C and aged 4 hrs at 135 C and cooled in air, and then aged at 200 C and cooled in air, and again heat-treated at 300 C.
25	227	L	1949	293-372	±4%	SA 1	11.0	5.0	0.5	0.6			0.05		0.2 Co; wrought; heated 3 hrs at 495-500 C and quenched in cold water, and then aged 16 hrs at 165 C and cooled in air.
26	227	L	1949	293-573	±4%	SA 1	11.0	5.0	0.5	0.6			0.05		0.2 Co; the above specimen again heat-treated at 300 C.
27	227	L	1949	293-273	±8%	SA 44	11.0	5.0	0.5	0.5	0.4		0.1		0.3 Co; wrought; heated 3 hrs at 495-500 C and quenched in cold water, and then aged 16 hrs at 165 C and cooled in air.
28	227	L	1949	293-573	±8%	SA 44	11.0	5.0	0.5	0.5	0.4		0.1		0.3 Co; the above specimen again heat-treated at 300 C.
29	408	E	1925	304.2	< 0.5	K	6.13	3.8	0.92	1.58	0.58				Chill-cast.
30	408	E	1925	296.2	< 0.5	K	6.13	3.8	0.92	1.58	0.58				The above specimen annealed for 30 min at 450 C.
31	408	E	1925	296.2	< 0.5	K	6.13	3.8	0.92	1.58	0.58				The above annealed specimen heated for 30 min at 500 C, then quenched in water at about 8 C, and then measured after 4 to 5 hrs.
32	408	E	1925	311.2	< 0.5	K	6.13	3.8	0.92	1.58	0.58				The above quenched specimen measured after aging for 2 weeks.
33	408	E	1925	302.2	< 0.5	S	11.88		0.80						Chill-cast.
34	408	E	1925	301.2	< 0.5	S	11.88		0.80						The above specimen annealed for 30 min at 450 C.
35	408	E	1925	300.2	< 0.5	S	11.88		0.80						The above annealed specimen heated for 30 min at 500 C, then quenched in water at about 8 C, and then measured after 4 to 5 hrs.
36	408	E	1925	304.2	< 0.5	S	11.88		0.80						The above quenched specimen measured after aging for 2 weeks.
37	525	L	1937	323-623	7.0	4	11.0	0.95	0.25	0.95	0.04	0.93			85.87 Al, 0.01 Co; stamped and annealed at 180-210 C for several hrs.
38	525	L	1937	323-623	7.0	5	12.45	1.21	0.35	0.74	0.05	0.94			84.26 Al; cast and annealed at 180-210 C for several hrs.
39	525	L	1937	323-623	7.0	6	17.36	1.47	0.61	0.67	1.73	1.48		0.05	75.44 Al, 1.18 Co; cast and annealed at 460 C.
40	527	L	1935	398, 488		RR 50	2.2	1.3	1.0	0.1		1.3	0.18		Cast.
41	527	L	1935	398, 488		RR 50	2.2	1.3	1.0	0.1		1.3	0.18		Annealed at 175 C for 24 hrs.

SPECIFICATION TABLE NO. 247 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Si	Cu	Fe	Mg	Mn	Ni	Ti	Zn	Composition (continued), Specifications and Remarks
42	527	L	1935	398, 488		RR 50	2.2	1.3	1.0	0.1		1.3	0.18		Annealed at 250 C for 24 hrs.
43	527	L	1935	398, 488		γ-Silumin modified	12.0	1.2		0.5	0.5				Tempered.
44	527	L	1935	398, 488		γ-Silumin modified	12.0	1.2		0.5	0.5				Tempered and annealed at 175 C for 24 hrs.
45	527	L	1935	398, 488		γ-Silumin modified	12.0	1.2		0.5	0.5				Tempered and annealed at 250 C for 24 hrs.
46	527	L	1935	398, 488		Silumin sodium modified	12.0	1.2		0.5	0.5				0.06 Na; sand-cast; porous rod; specific weight 2.57.
47	527	L	1935	398, 488		Silumin sodium modified	12.0	1.2		0.5	0.5				0.06 Na; sand-cast; porous rod; specific weight 2.67.
48	524	L	1960	4.0-120		1100 F	0.13	0.1	0.1	0.1	0.001		0.01		0.1 Ga, 0.1 V, 0.02 Cr, 0.01 Pb, 0.01 Sn, 0.001 Ca, 0.001 Zr; drawn specimen 3.66 mm dia; avg grain size 0.024 mm x 0.098 mm (longitudinal) and 0.012 mm (transverse).
49	93	L	1931	87-476	3-4	K-S alloy 245	14	4.5		0.7	1.0	1.5			Nominal composition, cast; electrical conductivity 27.5, 12.5, 9.9 and 8.0 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K respectively.
50	93	L	1931	87-476	3-4	K-S alloy 280	21	1.5		0.5	0.7				1.2 Co; similar to the above specimen except electrical conductivity 27.8, 9.61, 8.0 and 5.54 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373, and 476 K respectively.

DATA TABLE NO. 247 THERMAL CONDUCTIVITY OF [ALUMINUM + SILICON + ΣX_i] ALLOYS

(Al + Si < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

CURVE 1

T	k
324.2	1.883
374.2	1.837
423.2	1.812
473.2	1.833
523.2	1.841

CURVE 2

T	k
325.2	1.577
373.2	1.611
423.2	1.619
475.2	1.753
524.2	1.824

CURVE 3*

T	k
373.2	1.791

CURVE 4*

T	k
373.2	1.820
475.2	1.799
436.2	1.820

CURVE 5

T	k
323.2	1.615
373.2	1.565
424.2	1.619
472.2	1.699
523.2	1.782

CURVE 6

T	k
323.2	1.774
373.2	1.761

CURVE 7

T	k
298.2	1.138
473.2	1.289

CURVE 8

T	k
298.2	1.498
473.2	1.778

CURVE 9

T	k
298.2	1.866
473.2	1.987

CURVE 10

T	k
298.2	1.674
473.2	1.690

CURVE 11

T	k
298.2	1.360
473.2	1.389

CURVE 12

T	k
298.2	1.900
473.2	1.946

CURVE 13

T	k
298.2	2.096
473.2	2.142

CURVE 14*

T	k
298.2	1.778
473.2	1.749

CURVE 15*

T	k
293.2	1.611
373.2	1.674
473.2	1.715
573.2	1.757

CURVE 16

T	k
293.2	1.339
373.2	1.423
473.2	1.569

CURVE 17*

T	k
293.2	1.632
373.2	1.695

CURVE 17 (cont.)*

T	k
473.2	1.736
573.2	1.736

CURVE 18

T	k
293.2	1.883
373.2	1.883
473.2	1.862
573.2	1.841

CURVE 19

T	k
293.2	1.381
373.2	1.590

CURVE 20

T	k
293.2	1.632*
373.2	1.632*
473.2	1.632
573.2	1.590

CURVE 21

T	k
293.2	1.255
373.2	1.339

CURVE 22

T	k
293.2	1.632*
373.2	1.548
473.2	1.548
573.2	1.548

CURVE 23*

T	k
293.2	1.590
373.2	1.611
473.2	1.674

CURVE 24*

T	k
293.2	1.736
373.2	1.757
473.2	1.757
573.2	1.841

CURVE 25*

T	k
293.2	1.297
372.2	1.381

CURVE 26*

T	k
293.2	1.799
373.2	1.757
473.2	1.757
573.2	1.757

CURVE 27*

T	k
293.2	1.339
373.2	1.423

CURVE 28*

T	k
293.2	1.632
373.2	1.674
473.2	1.715
573.2	1.715

CURVE 29

T	k
304.2	0.996

CURVE 30*

T	k
298.2	1.356

CURVE 31*

T	k
296.2	1.163

CURVE 32*

T	k
311.2	1.138

CURVE 33*

T	k
302.2	1.310

CURVE 34*

T	k
301.2	1.776

CURVE 35*

T	k
300.2	1.732

CURVE 36*

T	k
304.2	1.812

CURVE 37

T	k
323.2	1.34
373.2	1.34*
423.2	1.38
473.2	1.38
523.2	1.46
573.2	1.46
623.2	1.46

CURVE 38*

T	k
323.2	1.34
373.2	1.38
423.2	1.38
473.2	1.36
523.2	1.42
573.2	1.42
623.2	1.46

CURVE 39*

T	k
323.2	1.17
373.2	1.21
423.2	1.26
473.2	1.26
523.2	1.30
573.2	1.34
623.2	1.38

CURVE 40*

T	k
398.2	1.477
486.2	1.636

CURVE 41*

T	k
398.2	1.506
488.2	1.569

CURVE 42*

T	k
398.2	1.615
488.2	1.644

CURVE 43*

T	k
398.2	1.410
488.2	1.464

CURVE 44*

T	k
398.2	1.477
488.2	1.498

CURVE 45*

T	k
398.2	1.583
488.2	1.586

CURVE 46*

T	k
398.2	1.305
488.2	1.402

CURVE 47*

T	k
398.2	1.406
488.2	1.523

CURVE 48

T	k
4	0.554
6	0.823
8	1.107
10	1.395
14	1.96
20	2.70
24	3.12
30	3.58
40	3.89
50	3.78
60	3.40
80	2.74
100	2.38
120	2.23

CURVE 49

T	k
87.0	0.996
273.0	1.067
373.0	1.117
476.0	1.184

CURVE 50

T	k
87.0	0.795
273.0	0.996
373.0	1.059
476.0	1.105

*Not shown on plot

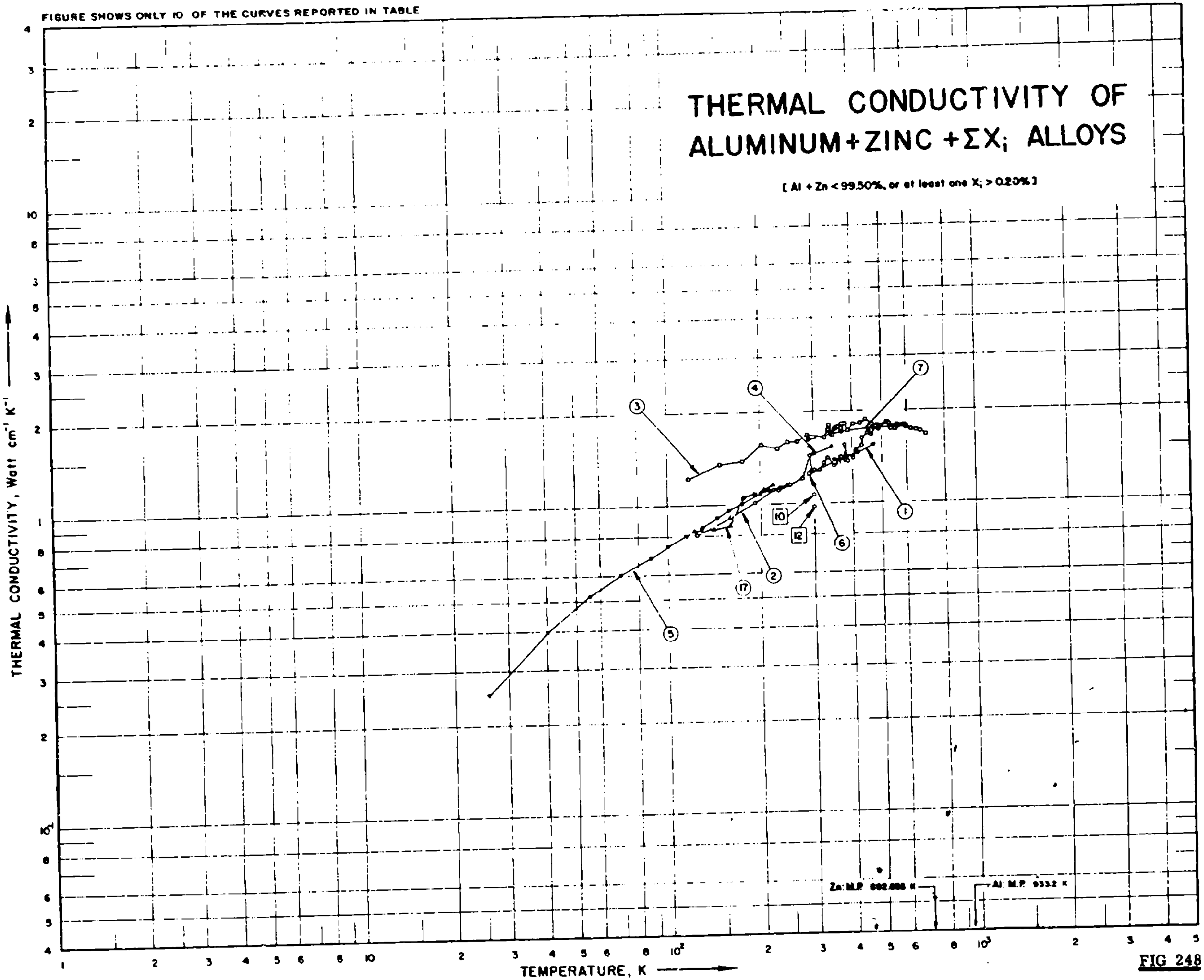


FIGURE SHOWS ONLY 10 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF ALUMINUM + ZINC + ΣXᵢ ALLOYS
[Al + Zn < 99.50%, or at least one Xᵢ > 0.20%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Zn: M.P. 692.655 K
Al: M.P. 933.2 K
1
2
3
4
5
6
7
10
12
17

FIG 248

SPECIFICATION TABLE NO. 248 THERMAL CONDUCTIVITY OF [ALUMINUM + ZINC + ΣX_i] ALLOYS

($Al + Zn < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 248]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Zn	Cr	Cu	Fe	Mg	Mn	Si	Ti	Composition (continued), Specifications and Remarks
1	55	PL	1928	353-473		Bar 661	13.0		0.3						Cast and annealed.
2	91	C	1951	125-609		7075	5.6	0.3	1.6		2.5				As received.
3	91	C	1951	117-702		7075	5.6	0.3	1.6		2.5				After heated at about 275 C.
4	25		1921	301,346			10.0		2.0				Trace		
5	226	L	1951	26-250	< 2.0	7075	5.5	0.3	1.5		2.5	0.2			Nominal composition.
6	227	L	1949	293, 373		RR 77	4.96		2.20	0.31	2.54	0.54	0.26	Trace	Wrought; 2 hrs solution heat treatment at 450 C and quenched in water at 70 C, and then aged 4 hrs at 135 C and cooled in air.
7	227	L	1949	293-573		RR 77	4.96		2.20	0.31	2.54	0.54	0.26	Trace	The above specimen again heated at 300 C.
8	408	E	1925	307	< 0.5	British L-5	12.02		2.70	0.57			0.39		Chill-cast.
9	408	E	1925	301	< 0.5	British L-5	12.62		2.70	0.57			0.39		The above specimen annealed for 30 min at 450 C.
10	408	E	1925	301	< 0.5	A	20.32		2.57	0.57			0.37		Chill-cast.
11	408	E	1925	300	< 0.5	A	20.32		2.57	0.57			0.37		The above specimen annealed for 30 min at 450 C.
12	408	E	1925	300	< 0.5	A	20.32		2.57	0.57			0.37		The above annealed specimen heated for 30 min at 500 C, quenched in water at about 8 C, and then measured after 4 to 5 hrs.
13	408	E	1925	305	< 0.5	A	20.32		2.57	0.57			0.37		The above quenched specimen measured after aging for 2 weeks.
14	408	E	1925	304	< 0.5	G	2.55		2.53	0.84	Trace	0.46	0.32		Chill-cast.
15	408	E	1925	301	< 0.5	G	2.55		2.53	0.84	Trace	0.46	0.32		The above specimen annealed for 30 min at 450 C.
16	408	E	1925	302	< 0.5	G	2.55		2.53	0.84	Trace	0.46	0.32		The above annealed specimen heated for 30 min at 500 C, quenched in water at about 8 C, and then measured after 4 to 5 hrs.
17	685	L	1963	122-221		7075-T6	5.1 6.1	0.18 0.40	1.2 2.0	0.7	2.1 2.9	0.30	0.50	0.20	Nominal composition; cross sectional area 0.105 cm^2 and 2.55 cm long.

DATA TABLE NO. 248 THERMAL CONDUCTIVITY OF [ALUMINUM + ZINC + ΣX_i] ALLOYS

($Al + Zn < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, K, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
353.00	1.339
423.00	1.464
473.00	1.548

CURVE 2

T	k
125.10	0.803
161.50	0.916
193.90	1.008
223.30	1.117
232.40	1.109
254.90	1.155
276.50	1.218
294.70	1.443
297.10	1.272
305.10	1.297
316.00	1.297
326.60	1.360
337.50	1.406
352.20	1.331
364.40	1.356
380.50	1.406
381.10	1.389
381.50	1.548
390.50	1.372
397.40	1.423
408.90	1.410
412.80	1.469
413.10	1.485
433.90	1.544
434.70	1.615
353.50	1.695
458.00	1.707
466.60	1.661
480.20	1.770
491.50	1.736
500.70	1.778
533.20	1.807
533.50	1.787
566.20	1.795
571.00	1.770
609.30	1.766

CURVE 3

T	k
117.30	1.2[illegible]
148.30	1.356
177.30	1.389
204.50	1.561
230.00	1.519
249.90	1.590
269.30	1.598
288.30	1.665
327.20	1.636
333.60	1.741
33[illegible]	1.799
34[illegible]	1.695
345.90	1.686
349.30	1.661
354.50	1.749
360.40	1.770
364.10	1.770
371.10	1.753
373.60	1.807
381.70	1.820
390.10	1.715
408.90	1.807
427.10	1.820
445.10	1.870
489.50	1.778
425.50	1.837
538.10	1.745
557.10	1.736
561.40	1.795
583.30	1.782
597.70	1.787
604.60	1.774
628.60	1.736
652.40	1.715
674.90	1.703
701.80	1.665

CURVE 4

T	k
301.00	1.452
346.20	1.527

CURVE 5

T	k
25.76	0.251
40.22	0.397
55.18	0.519
70.24	0.607
88.03	0.682
100.18	0.745
115.10	0.803
130.40	0.858
145.63	0.912
159.83	0.962
175.31	1.004
202.39	1.088
215.30	1.113
235.06	1.138
249.86	1.163

CURVE 6

T	k
293.20	1.255
373.20	1.423

CURVE 7

T	k
293.20	1.632
373.20	1.715
473.20	1.757
573.20	1.757

CURVE 8*

T	k
307.2	1.32

CURVE 9*

T	k
301.2	1.33

CURVE 10

T	k
301.2	1.07

CURVE 11*

T	k
300.2	1.08

CURVE 12

T	k
300.2	0.979

CURVE 13*

T	k
305.2	0.975

CURVE 14*

T	k
304.2	1.26

CURVE 15*

T	k
301.2	1.45

CURVE 16*

T	k
302.2	1.32

CURVE 17

T	k
122	0.83
141	0.84
160	0.86
177	1.06
192	1.08
207	1.12
221	1.17

* Not shown on plot

SPECIFICATION TABLE NO. 249 THERMAL CONDUCTIVITY OF [ALUMINUM + ΣX_i] ALLOYS $Al + \Sigma X_i$

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Composition (continued), Specifications and Remarks
1	4	E	1911	373-873			95	Commercial purity.
2	6	L	1931	356-827			99	Sp density (20°C) = 2.70.
3	88	L	1908	113-291			99	Turned from a rod supplied by Jonnson, Matthey and Co.; density 2.70 g cm^{-3} at 20 C; electrical resistivity 2.72 ohm cm^{-3} at 0 C.
4	405	L	1940	399-623	±1.0		99.5	Cast at 700 C and molded at 200 C; drawn to 6.5 mm dia.

DATA TABLE NO. 249 THERMAL CONDUCTIVITY OF [ALUMINUM + ΣX_i] ALLOYS $Al + \Sigma X_i$

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k	T	k
CURVE 1*		CURVE 2 (cont.)*		CURVE 3 (cont.)*	
273.20	2.050	595.20	2.210	198.20	2.063
473.20	2.343	638.20	2.180	223.20	2.075
573.20	2.720	665.20	2.167	248.20	2.088
673.20	3.180	676.20	2.170	273.20	2.100
773.20	3.682	720.20	2.120	291.20	2.110
873.20	4.225	771.20	2.095		
		771.20	2.063		
CURVE 2*		792.20	2.075	CURVE 4*	
		827.20	2.105		
356.20	2.205			399.2	2.057
373.20	2.125	CURVE 3*		410.2	2.068
393.20	2.197			428.2	2.105
452.20	2.218	113.20	2.150	508.2	2.092
477.20	2.247	123.20	2.125	591.2	2.161
511.20	2.260	148.20	2.055	623.2	2.219
569.20	2.234	173.20	2.058		

* No graphical presentation

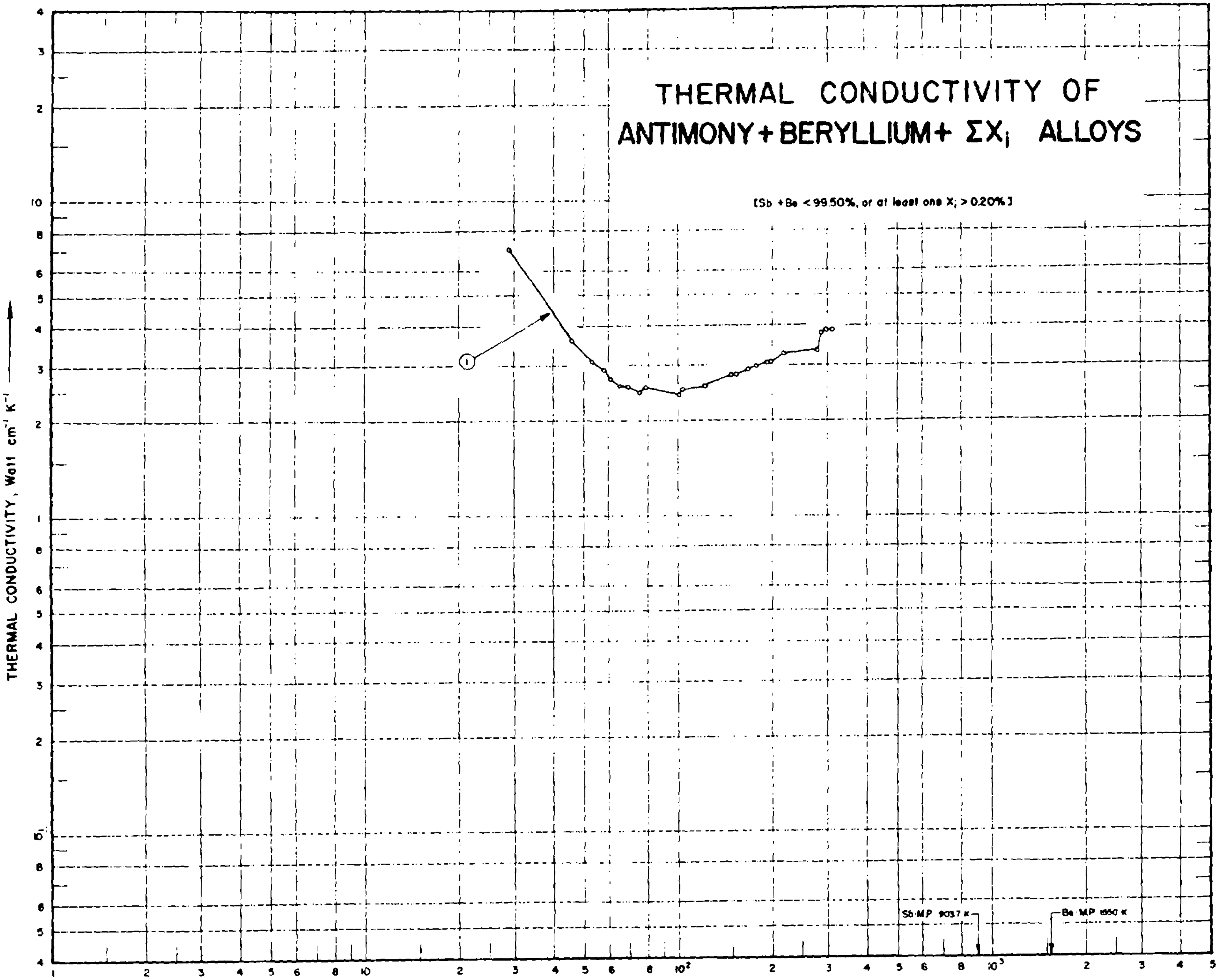

THERMAL CONDUCTIVITY OF
ANTIMONY + BERYLLIUM + ΣX_i ALLOYS
[Sb + Be < 99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
Sb M.P. 903.7 K
Be M.P. 1550 K
1

FIG 250

SPECIFICATION TABLE NO. 250 THERMAL CONDUCTIVITY OF [ANTIMONY + BERYLLIUM + ΣX_i] ALLOYS

($Sb + Be < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 250]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb	Be	Pb	Composition (continued), Specifications and Remarks
1	1001	L	1964	29-313			64.5	35	0.5	Single crystal; specimen ~8 mm long with cross section ~0.25 cm^2; heat flow measured parallel to c-axis.

DATA TABLE NO. 250 THERMAL CONDUCTIVITY OF [ANTIMONY + BERYLLIUM + ΣX_i] $Sb + Be + \Sigma X_i$

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
28.9	7.03
45.9	3.63
53.1	3.10
58.4	2.90
61.6	2.72
65.4	2.59
69.3	2.58
75.7	2.46
79.7	2.56
101.8	2.43
104.8	2.52
123.0	2.59
148.5	2.80
153.5	2.80
168.1	2.92
178.7	3.00
192.0	3.09
198.7	3.09
219.4	3.30
278.3	3.39
288.0	3.81
297.2	3.91
312.5	3.90

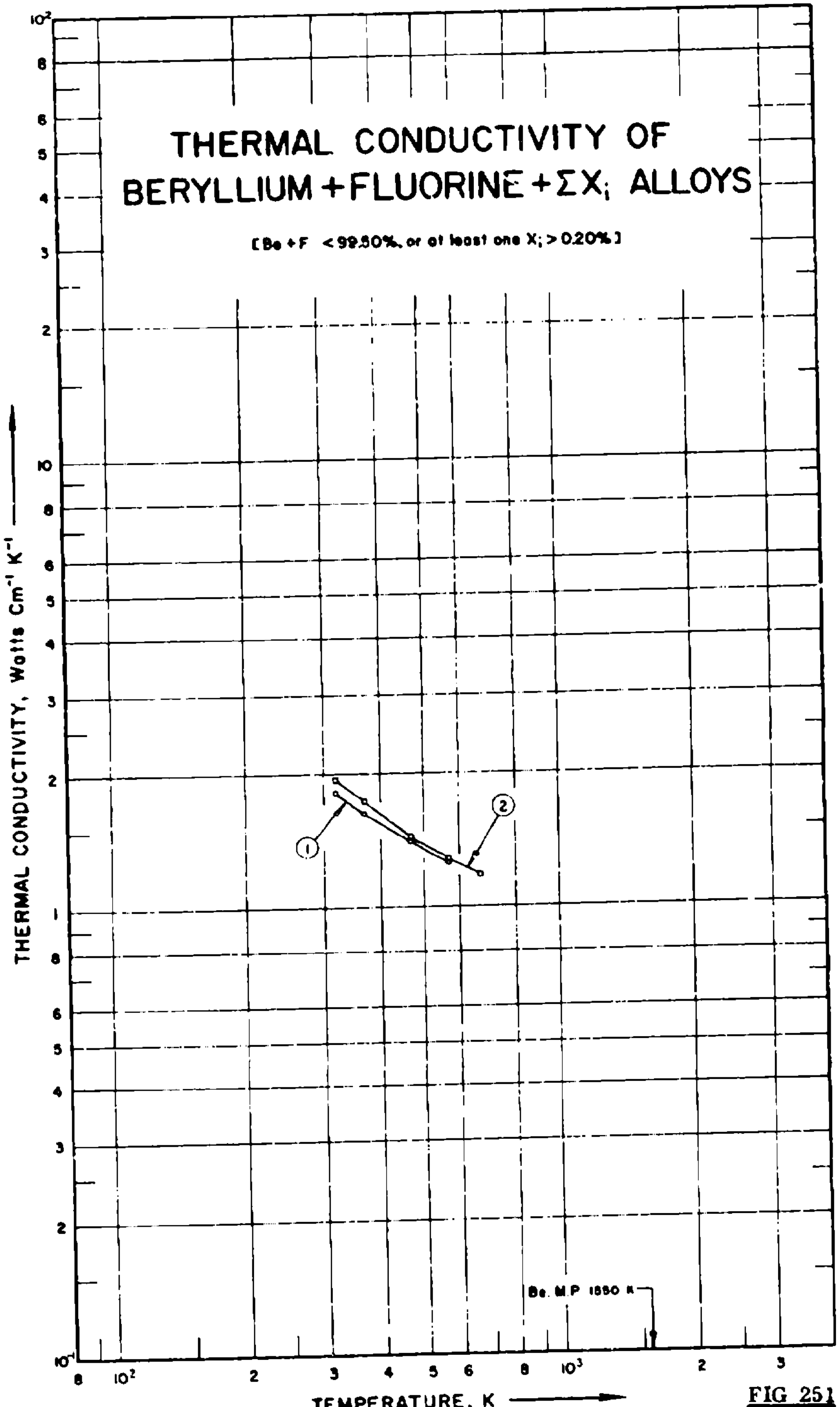

THERMAL CONDUCTIVITY OF
BERYLLIUM + FLUORINE + ΣX; ALLOYS
[Be + F < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Be. M.P. 1550 K
1
2

FIG 251

SPECIFICATION TABLE NO. 251 THERMAL CONDUCTIVITY OF [BERYLLIUM + FLUORINE + ΣX_i] ALLOYS

(Be + F < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 251]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Be	Fe	Al	Mg	Mn	Composition (continued), Specifications and Remarks
1	111	C	1953	323-573		Xi A.R.	Bal	0.53		0.34		0.53 Fe and 0.34 Mg in the form of MgF2; other impurities C, Ca, Al, and Mn.
2	111	C	1953	323-673		Xi H.T.	Bal	0.53		0.34		The above specimen after heat treatment at 700 C.

DATA TABLE NO. 251 THERMAL CONDUCTIVITY OF [BERYLLIUM + FLUORINE + ΣX_i] ALLOYS

($Be + F < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
323.2	1.81
373.2	1.63
473.2	1.40
573.2	1.25
CURVE 2	
323.2	1.93
373.2	1.70
473.2	1.43
573.2	1.27
673.2	1.17

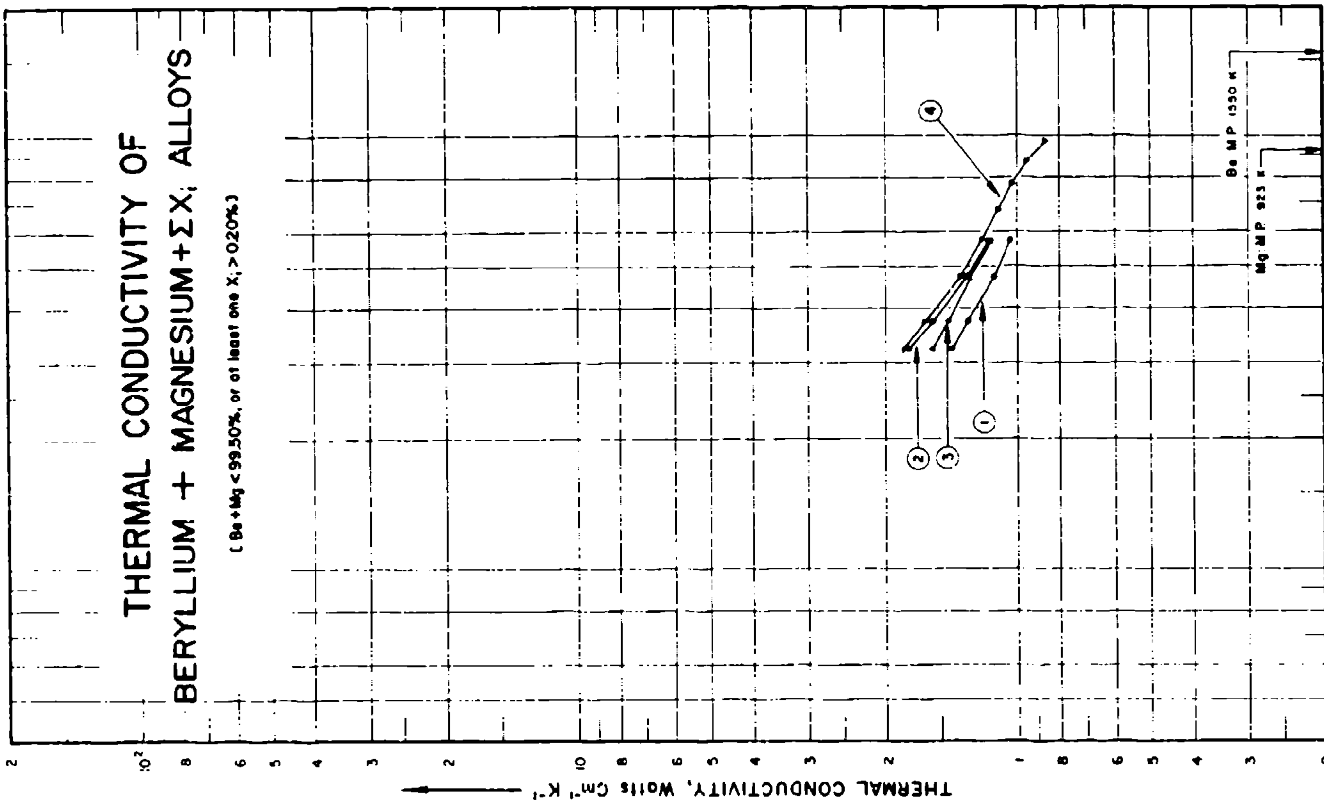

THERMAL CONDUCTIVITY OF
BERYLLIUM + MAGNESIUM + ΣXi ALLOYS
(Be + Mg < 99.50%, or at least one Xi > 0.20%)
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Be M.P. 1550 K
Mg M.P. 923 K
1
2
3
4

FIG 252

SPECIFICATION TABLE NO. 252 THERMAL CONDUCTIVITY OF [BERYLLIUM + MAGNESIUM + ΣX_i] ALLOYS

(Be + Mg < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 252]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Be	Mg	Al	Ca	C	F	Fe	Composition (continued), Specifications and Remarks
1	111	C	1953	323-573		II A.R.	96.5	1.81	0.06	0.035	0.032	1.52	0.55	Traces of Cu and Mn; chill-cast and machined.
2	111	C	1953	323-573		II H.T.	96.5	1.81	0.06	0.035	0.032	1.52	0.55	Traces of Cu and Mn; the above specimen after heat treatment at about 700 C.
3	111	C	1953	323-573		V A.R.								Approx. the same as the specimen II A.R.
4	111	C	1953	323-973		V H.T.								The above specimen after heat treatment at 700 C.

DATA TABLE NO. 252 THERMAL CONDUCTIVITY OF [BERYLLIUM + MAGNESIUM + ΣX_i] ALLOYS

($Be + Mg < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
323.2	1.41
373.2	1.30
473.2	1.13
573.2	1.04
CURVE 2	
323.2	1.76
373.2	1.55
473.2	1.31
573.2	1.17
CURVE 3	
323.2	1.56
373.2	1.44
473.2	1.28
573.2	1.16
CURVE 4	
323.2	1.80
373.2	1.61
473.2	1.35
573.2	1.21
673.2	1.11
773.2	1.03
873.2	0.95
973.2	0.86

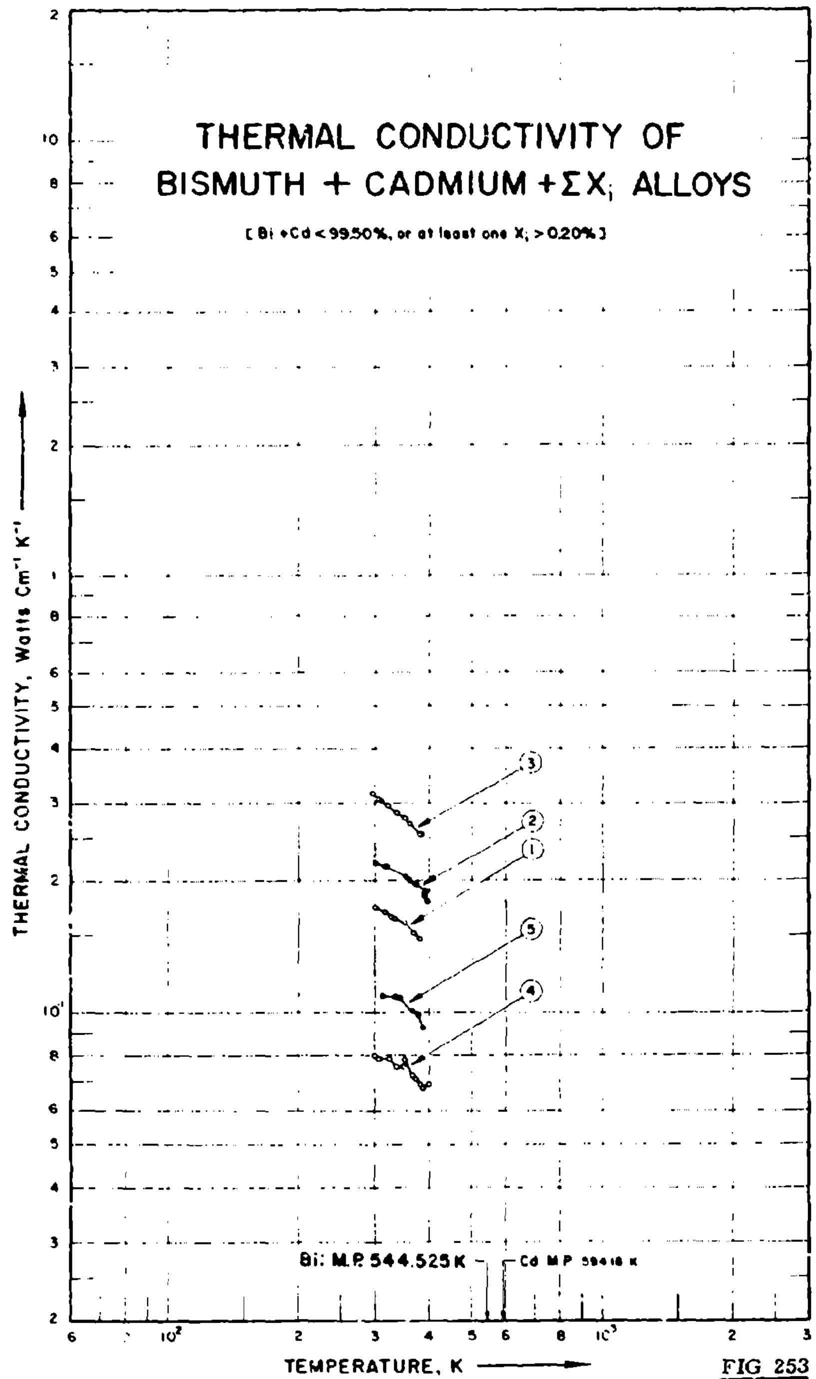

THERMAL CONDUCTIVITY OF
BISMUTH + CADMIUM + ΣXᵢ ALLOYS
[Bi + Cd < 99.50%, or at least one Xᵢ > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Bi: M.P. 544.525 K
Cd M.P. 594.18 K
1
2
3
4
5

FIG 253

SPECIFICATION TABLE NO. 253 THERMAL CONDUCTIVITY OF [BISMUTH + CADMIUM + ΣX_i] ALLOYS

(Bi + Cd < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 253]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi	Cd	Pb	Composition (continued), Specifications and Remarks
1	383		1956	304-382			77.03	21.4	1.57	Calculated composition; electrical conductivity 1.449, 1.399, 1.376, 1.357, 1.325, 1.261 and 1.222 x 10^4 ohm^{-1} cm^{-1} at 30.5, 44.8, 55.0, 62.1, 77.9, 96.3 and 108.4 C, respectively.
2	383		1956	308-398			73.7	24.8	1.5	Calculated composition; electrical conductivity 1.507, 1.479, 1.468, 1.391, 1.361, 1.328, 1.298, 1.273 and 1.233 x 10^4 ohm^{-1} cm^{-1} at 34.5, 46.5, 48.0, 82.6, 89.6, 101.7, 119.0, 120, 125.2 C, respectively.
3	383		1956	298-383			59.49	39.3	1.21	Calculated composition; electrical conductivity 2.923, 2.835, 2.797, 2.722, 2.633, 2.601, 2.555, 2.478, 2.351 and 2.352 x 10^4 ohm^{-1} cm^{-1} at 24.7, 35.0, 39.9, 50.4, 64.9, 70.6, 80.0, 91.1, 108.9 and 109.8 C, respectively.
4	383		1956	300-399			94.86	3.2	1.94	Calculated composition; electrical conductivity 0.494, 0.486, 0.478, 0.467, 0.467, 0.464, 0.449, 0.441, 0.424, 0.420 and 0.423 x 10^4 ohm^{-1} cm^{-1} at 27.1, 34.2, 53.4, 63.3, 76.3, 86.1, 94.5, 99.6, 109.4, 113.8 and 125.8 C, respectively.
5	383		1956	314-388			88.59	9.6	1.81	Calculated composition; electrical conductivity 0.736, 0.724, 0.721, 0.682, 0.666 and 0.623 x 10^4 ohm^{-1} cm^{-1} at 40.3, 62.9, 70.5, 194.8, 103.6 and 14.6 C, respectively.

DATA TABLE NO. 253 THERMAL CONDUCTIVITY OF [BISMUTH + CADMIUM + ΣX_i] ALLOYS

(Bi + Cd < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
303.7	0.174
318.0	0.169
328.2	0.166
335.3	0.164
351.1	0.160
369.5	0.152
38[illegible].6	0.147
CURVE 2	
307.7	0.219
319.7	0.215
321.2	0.214
355.8	0.203
362.8	0.200
374.9	0.196
392.2	0.189
393.2	0.185
398.4	0.179
CURVE 3	
297.9	0.317
308.2	0.308
313.1	0.303
323.6	0.295
338.1	0.285
343.8	0.282
353.2	0.277
364.3	0.269
382.1	0.254
383.6	0.2[illegible]4
CURVE 4	
300.3	0.0795
307.4	0.0782
326.6	0.0782
336.5	0.0749
349.5	0.0749
353.3	0.0778
367.7	0.0729
372.8	0.0707
CURVE 4 (cont.)	
382.6	0.0682
387.0	0.0674
399.0	0.0682
CURVE 5	
313.5	0.109
336.1	0.108
343.7	0.107
368.0	0.101
376.8	0.0987
387.8	0.0925

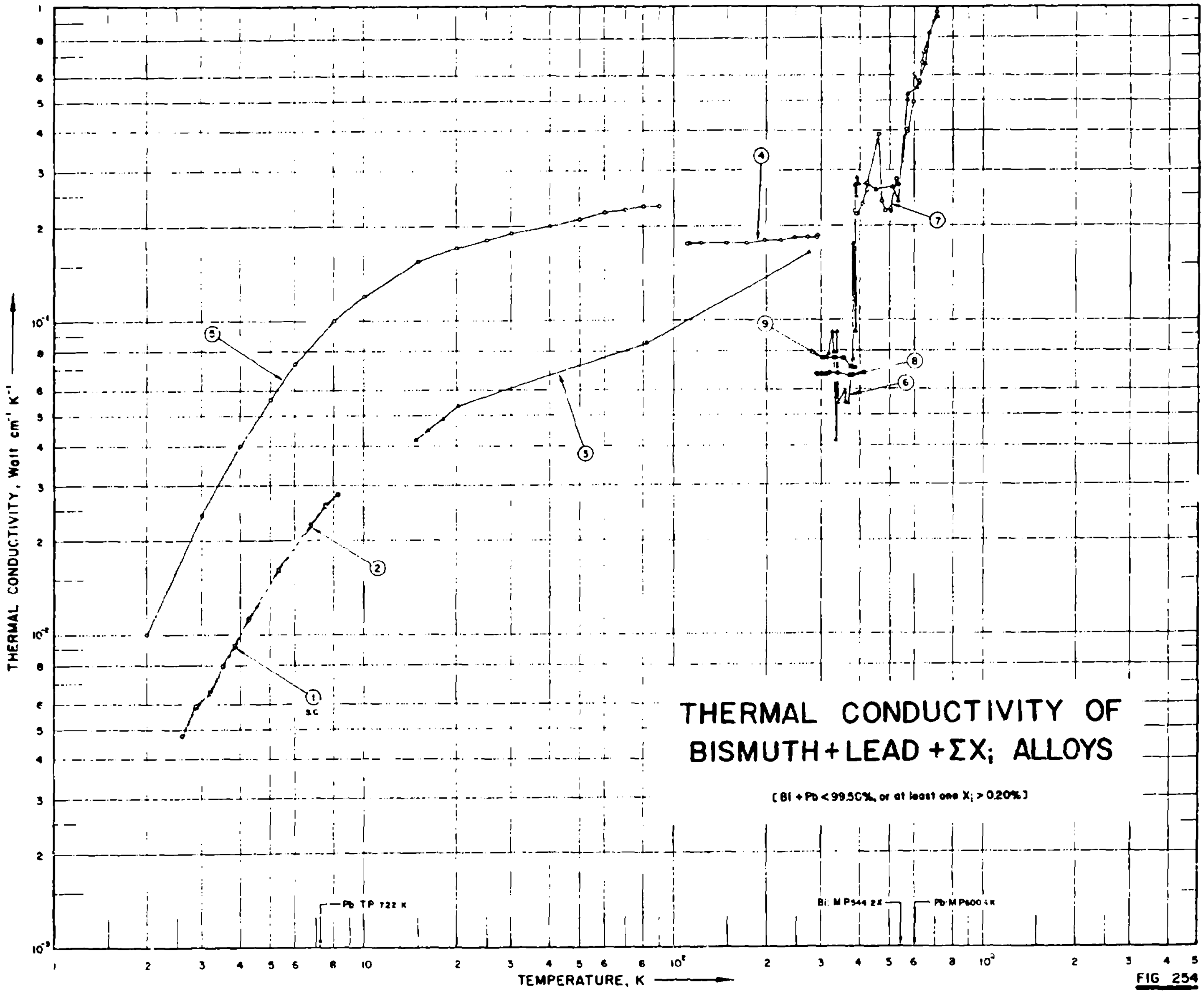

THERMAL CONDUCTIVITY OF
BISMUTH + LEAD + ΣX; ALLOYS
(Bi + Pb < 99.50%, or at least one X; > 0.20%)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Pb TP 7.22 K
Bi: M P 544.2 K
Pb: M P 600.4 K
1
S.C
2
3
4
5
6
7
8
9

FIG 254

SPECIFICATION TABLE NO. 254 THERMAL CONDUCTIVITY OF [BISMUTH + LEAD + ΣX_i] ALLOYS

($Bi + Pb < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 254]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi	Pb	Cd	Sn	Composition (continued), Specifications and Remarks
1	228	L	1936	2.6-8.3		Rose Metal	50	25		25	Near eutectic; in superconducting state at zero gauss.
2	228	L	1936	2.6-8.3		Rose Metal	50	25		25	Near eutectic; at 721 gauss (also superconducting).
3	228	L	1936	15-276		Rose Metal	50	25		25	Near eutectic; in normal state at zero gauss.
4	88	L	1908	111-295		Lipowitz alloy	50	25	11	14	
5	229	L	1955	2.0-90		Wood's Metal	48	26	13	13	Nominal composition; state unspecified.
6	247	E	1950	319-714	±3.0		≈50.35	31.20	9.70	8.80	Data cover both solid and liquid states.
7	247	E	1950	387-822	±3.0		≈50.35	31.20	9.70	8.80	Data cover both solid and liquid states.
8	383		1956	292-381			97.02	1.98	1.00		
9	383		1956	305-396			96.53	1.97	1.50		

DATA TABLE NO. 254 THERMAL CONDUCTIVITY OF [BISMUTH + LEAD + ΣX_i] ALLOYS

(Bi + Pb < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
2.60	0.00476
2.88	0.00581
3.20	0.00658
3.53	0.00794
3.85	0.00917
4.26	0.0113
5.31	0.0160
6.74	0.0225
7.52	0.0260
8.26	0.0280
CURVE 2	
2.60	0.00474
2.88	0.00588
3.20	0.00654
3.53	0.00794
3.85	0.00926
4.26	0.0112
5.31	0.0161
6.73	0.0223
7.52	0.0259
8.26	0.0280
CURVE 3	
14.70	0.0418
16.10	0.0448
17.90	0.0485
20.10	0.0532
82.00	0.0847
276.00	0.164
CURVE 4	
111.20	0.175
113.20	0.176
123.20	0.176
148.20	0.176
173.20	0.176
198.20	0.180
223.20	0.180
248.20	0.184
CURVE 4 (cont.)	
273.20	0.184
291.20	0.184
295.20	0.186
CURVE 5	
2.00	0.010
3.00	0.024
4.00	0.040
5.00	0.056
6.00	0.073
8.00	0.100
10.00	0.120
15.00	0.155
20.00	0.170
25.00	0.180
30.00	0.190
40.00	0.200
50.00	0.210
60.00	0.220
70.00	0.225
80.00	0.230
90.00	0.230
CURVE 6	
319.10	0.079
327.40	0.092
331.20	0.0795
336.50	0.0418
339.80	0.092
342.40	0.0544
358.80	0.0588
363.00	0.0544
370.50	0.0544
380.10	0.0753
381.80	0.176
396.10	0.092
388.10	0.092
388.20	0.268
391.30	0.247
393.60	0.285
399.90	0.268
CURVE 6 (cont.)	
428.40	0.268
452.70	0.260
513.90	0.264
535.40	0.238
571.80	0.502
572.50	0.523
618.70	0.548
651.50	0.653
678.80	0.820
714.40	0.929
CURVE 7	
387.20	0.222
390.50	0.218
393.00	0.218
410.60	0.234
421.50	0.259
425.30	0.272
461.80	0.389
475.50	0.238
485.30	0.222
507.20	0.226
509.20	0.222
530.10	0.280
531.70	0.268
533.60	0.268
568.40	0.506
571.20	0.498
599.70	0.598
602.70	0.607
626.40	0.565
629.60	0.573
639.40	0.661
649.40	0.720
712.50	0.958
739.40	1.092*
785.80	1.318*
821.70	1.858*
CURVE 8	
292.3	0.0674
301.7	0.0674
311.7	0.0674
321.9	0.0678
341.6	0.0678
372.0	0.0669
380.7	0.0669
CURVE 9	
304.5	0.0766
312.3	0.0766
331.1	0.0761
355.0	0.0757
374.5	0.0715
386.3	0.0707

*Not shown on plot

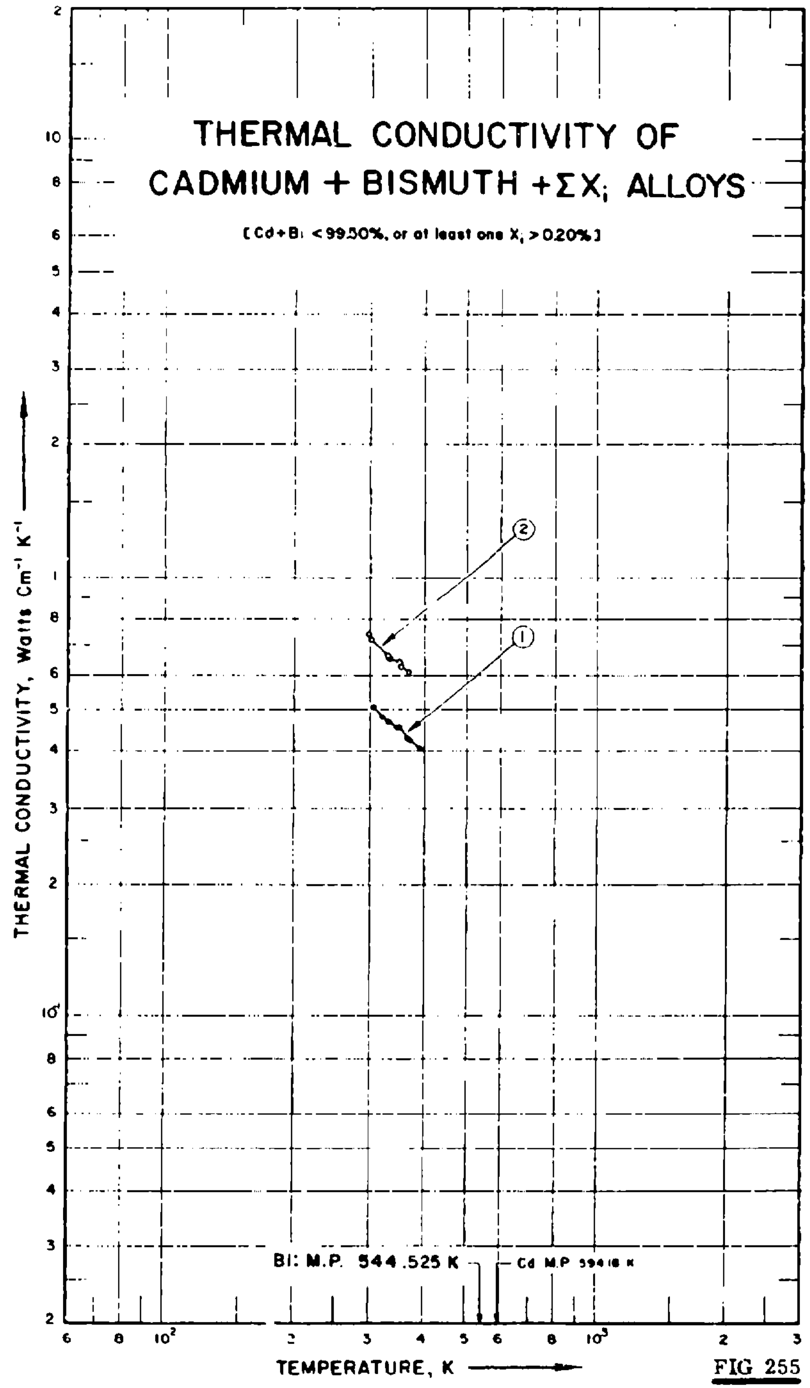

THERMAL CONDUCTIVITY OF
CADMIUM + BISMUTH +ΣX; ALLOYS
[Cd+Bi < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Bi: M.P. 544.525 K
Cd M.P.
1
2

FIG 255

SPECIFICATION TABLE NO. 255 THERMAL CONDUCTIVITY OF [CADMIUM + BISMUTH + ΣX_i] ALLOYS

(Cd + Bi < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 255]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cd	Bi	Pb	Composition (continued), Specifications and Remarks
1	383		1956	306-393			61.3	37.93	0.77	Calculated composition; electrical conductivity 4.98, 4.69, 4.59, 4.44, 4.42, 4.18, 4.14 and 3.97 x 10^4 ohm^{-1} cm^{-1} at 32.8, 46.8, 60.3, 73.8, 77.0, 95.0, 98.1 and 120.0 C, respectively.
2	383		1956	299-370			80.0	19.6	0.4	Calculated composition; electrical conductivity 7.38, 7.19, 6.62, 6.51, 6.42, 6.26 and 6.14 x 10^4 ohm^{-1} cm^{-1} at 25.6, 31.5, 58.9, 63.6, 77.5, 80.8 and 96.3 C, respectively.

DATA TABLE NO. 255 THERMAL CONDUCTIVITY OF [CADMIUM + BISMUTH + ΣX_i] ALLOYS

(Cd + Bi < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
306.0	0.510
320.0	0.481
333.5	0.469
347.0	0.452
350.2	0.452
368.2	0.427
371.3	0.423
393.2	0.406
CURVE 2	
298.8	0.741
308.7	0.720
332.1	0.661
336.8	0.653
350.7	0.644
354.0	0.628
369.5	0.615

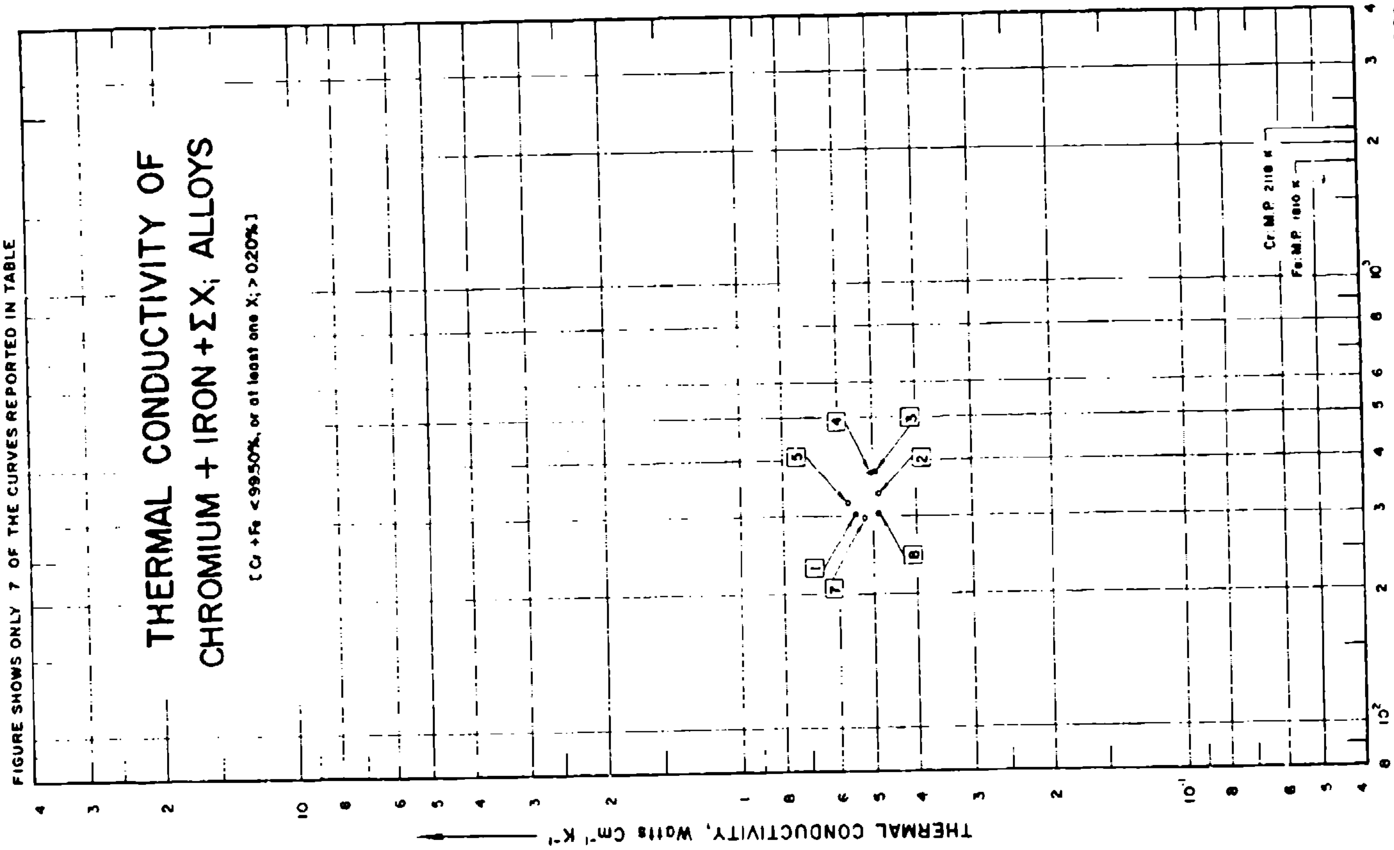


FIGURE SHOWS ONLY 7 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
CHROMIUM + IRON + ΣXᵢ ALLOYS
[Cr + Fe < 99.50%, or at least one Xᵢ > 0.20%]
Cr: M.P. 2118 K
Fe: M.P. 1810 K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 256

SPECIFICATION TABLE NO. 256 THERMAL CONDUCTIVITY OF [CHROMIUM + IRON + ΣX_i] ALLOYS

(Cr + Fe < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 256]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cr	Fe	C	Si	Composition (continued), Specifications and Remarks
1	204	L	1937	302.9		Ferrochromium,24	53.37	45.37	0.18	1.08	
2	204	L	1937	338.0		Ferrochromium,25	62.94	34.39	0.11	2.56	
3	204	L	1937	380.5		Ferrochromium,26	30.4	49.0	0.20	0.40	
4	204	L	1937	378.8		Ferrochromium,27	51.4	45.85	0.45	2.30	
5	204	L	1937	323.2		Ferrochromium,28	53.73	44.91	0.24	1.12	Obtained from fusion of iron with ferrochromium.
6	204	L	1937	379.4		Ferrochromium,29	56.12	41.31	1.64	0.93	
7	204	L	1937	299.6		Ferrochromium,30	53.8	41.3	4.45	0.45	
8	204	L	1937	305.7		Ferrochromium,31	62.7	30.6	6.25	0.45	

DATA TABLE NO. 256 THERMAL CONDUCTIVITY OF [CHROMIUM + IRON + ΣX_i] ALLOYS

($Cr + Fe < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
302.9	0.545
CURVE 2	
338.0	0.490
CURVE 3	
380.5	0.499
CURVE 4	
378.8	0.508
CURVE 5	
323.2	0.573
CURVE 6*	
379.4	0.501
CURVE 7	
299.6	0.521
CURVE 8	
305.7	0.489

*Not shown on plot

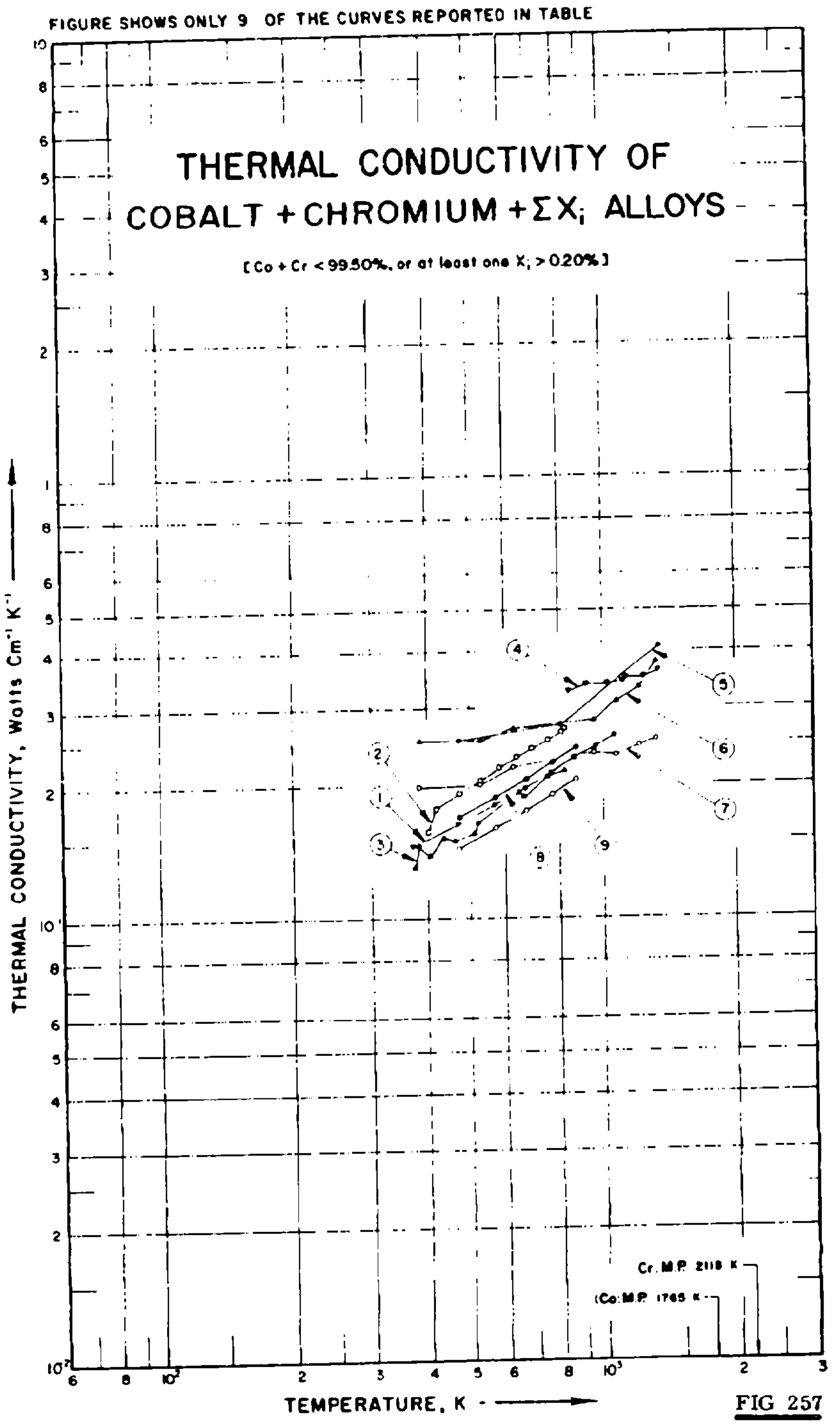


FIGURE SHOWS ONLY 9 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
COBALT + CHROMIUM + ΣX_i ALLOYS
[Co + Cr < 99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Cr. M.P. 2118 K
(Co: M.P. 1765 K

FIG 257

SPECIFICATION TABLE NO. 257 THERMAL CONDUCTIVITY OF [COBALT + CHROMIUM + ΣX_i] ALLOYS

(Co + Cr < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 257]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Co	Cr	Fe	Ni	W	C	Mo	Mn	Composition (continued), Specifications and Remarks
1	181	C	1953	373-1073		British G-32	46.6	19.1	15.64	10.5		0.27	2.2	0.77	0.52 Si, 1.4 Nb, 3.0 V.
2	37	C	1951	404-828	4.0	S 816	45.0	20.0	15.0	20.0					Lead used as comparative material.
3	37	C	1951	377-826	4.0	X-40	45.0	25.5	2.0	10.5	7.5	0.53			Lead used as comparative material.
4	43	L	1958	849-1356	5.0	Haynes stellite alloy	60.49	26.69	1.54	2.38		0.258	5.42		Specimen 6.75 in. in dia and 1.50 in. thick; as received.
5	376		1960	478-1366		WI-52	Bal.	20/ 22	1.5/ 2.5	1.0 Max	10/ 12	0.4/ 0.5		0.5 Max	1.5 - 2.0 Nb + Ta, 0.04 P, 0.04 S, 0.5 Si.
6	376	C	1960	388-1341		WI-52	Bal.	20/ 22	1.5/ 2.5	1.0 Max	10/ 12	0.4/ 0.5		0.5 Max	1.5 - 2.0 Nb + Ta, 0.04 P, 0.04 S, 0.5 Si; Armco iron used as comparative material.
7	376	C	1960	388-1341		WI-52	Bal.	20/ 22	1.5/ 2.5	1.0 Max	10/ 12	0.4/ 0.5		0.5 Max	1.5 - 2.0 Nb + Ta, 0.04 P, 0.04 S, 0.5 Si, specimen coated with chromium; Armco iron used as comparative material.
8	616		1947	473-873		Haynes stellite 21	Bal.	25/ 30	2.0 Max	1.5/ 3.5		0.2/ 0.35	4.5/ 6.5		Wrought; density 8.3 g cm^{-3}.
9	616		1947	473-873		H.S. No. 21	Bal.	25/ 30	2.0 Max	1.5/ 3.5		0.2/ 0.35	4.5/ 6.5		Density 8.3 g cm^{-3}.
10	616		1947	473-873		H.S. No. 23	Bal.	23/ 29	2.0 Max	1.5 Max	4/ 7	0.35/ 0.5			Density 8.54 g cm^{-3}.
11	616		1947	473-873		H.S. No. 31	Bal.	23/ 28	1.5 Max	9/ 12	6/ 9	0.45/ 0.6			Density 8.61 g cm^{-3}.

DATA TABLE NO. 257 THERMAL CONDUCTIVITY OF [COBALT + CHROMIUM + ΣX_i] ALLOYS

(Co + Cr < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k	T	k	T	k
CURVE 1		CURVE 4		CURVE 9	
373.2	0.146	848.8	0.325	473.2	0.145
473.2	0.163	930.2	0.336	573.2	0.160
573.2	0.180	1037.7	0.336	673.2	0.175
673.2	0.197	1127.7	0.341	773.2	0.190
773.2	0.213	1149.8	0.347	873.2	0.205
873.2	0.230	1264.1	0.348		
973.2	0.243	1355.6	0.358	CURVE 10*	
1073.2	0.259			473.2	0.154
		CURVE 5		573.2	0.176
CURVE 2		477.6	0.252	673.2	0.180
		810.9	0.274	773.2	0.189
404.0	0.157	1366.5	0.404	873.2	0.212
422.0	0.177				
477.6	0.192	CURVE 6		CURVE 11*	
533.2	0.205				
588.7	0.218	388.2	0.251	473.2	0.148
644.3	0.230	533.7	0.252	573.2	0.175
699.8	0.242	632.1	0.268	673.2	0.183
755.4	0.253	964.8	0.280	773.2	0.194
810.9	0.263	1088.2	0.309	873.2	0.219
827.6	0.267	1225.4	0.330		
		1341.4	0.378		
CURVE 3					
		CURVE 7			
377.2	0.130				
386.3	0.146	388.2	0.198		
408.4	0.138	533.7	0.200		
433.1	0.152	632.1	0.218		
464.8	0.149	964.8	0.235		
514.2	0.156	1088.2	0.232		
524.3	0.164	1225.4	0.245		
651.2	0.192	1341.5	0.252		
670.1	0.188				
752.2	0.208	CURVE 8			
826.2	0.215				
		473.2	0.170		
		573.2	0.188		
		673.2	0.206		
		773.2	0.224		
		873.2	0.242		

*Not shown on plot

SPECIFICATION TABLE NO. 258 THERMAL CONDUCTIVITY OF [COBALT + IRON + ΣX_i] ALLOYS Co + Fe + ΣX_i

(Co + Fe < 99.50% or at least one X_i > 0.20%)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Co	Fe	C	Cu	Composition (continued), Specifications and Remarks
1	208	E	1919	303.2		Co-Fe 9	67.988	30.72	0.195	0.086	0.093 Mn, 0.77 Ni, 0.009 P, 0.008 S, 0.131 Si.
2	208	E	1919	303.2		Co-Fe 10	77.695	20.95	0.21	0.058	0.062 Mn, 0.88 Ni, 0.006 P, 0.005 S, 0.134 Si.
3	208	E	1919	303.2		Co-Fe 11	78.402	11.18	0.225	0.029	0.031 Mn, 0.99 Ni, 0.003 P, 0.003 S, 0.137 Si.
4	208	E	1919	303.2		Co-Fe-Ni 12	97.12	1.4	0.24		1.1 Ni, 0.14 Si.

DATA TABLE NO. 258 THERMAL CONDUCTIVITY OF [COBALT + IRON + ΣX_i] ALLOYS Co + Fe + ΣX_i

(Co + Fe < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
303.2	0.720
CURVE 2*	
303.2	0.[illegible]12
CURVE 3*	
303.2	0.402
CURVE 4*	
303.2	0.692

* No graphical presentation

SPECIFICATION TABLE NO. 259 THERMAL CONDUCTIVITY OF [COBALT + NICKEL + ΣX_i] ALLOYS Co + Ni + ΣX_i

(Co + Ni < 99.50% or at least one X_i > 0.20%)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Co	Ni	Composition (continued), Specifications and Remarks
1	236	E	1927	303.2			95	5	Nickel obtained from Mond and Co. containing 0.1 Fe, 0.037 C, 0.019 S, 0.013 Cu, 0.006 Si, trace Cr, P, Al, and Mn impurities; cobalt obtained from Sugibayasi and Co. containing 0.20 Fe, 0.220 C, 0.05 Al, 0.034 S, 0.032 Si, 0.003 P, trace Ni, and Mn impurities; cast and machined; heated at 800 C for 40 min and slowly cooled.

DATA TABLE NO. 259 THERMAL CONDUCTIVITY OF [COBALT + NICKEL + ΣX_i] ALLOYS Co + Ni + ΣX_i

(Co + Ni < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
303.2	0.523

*No graphical presentation

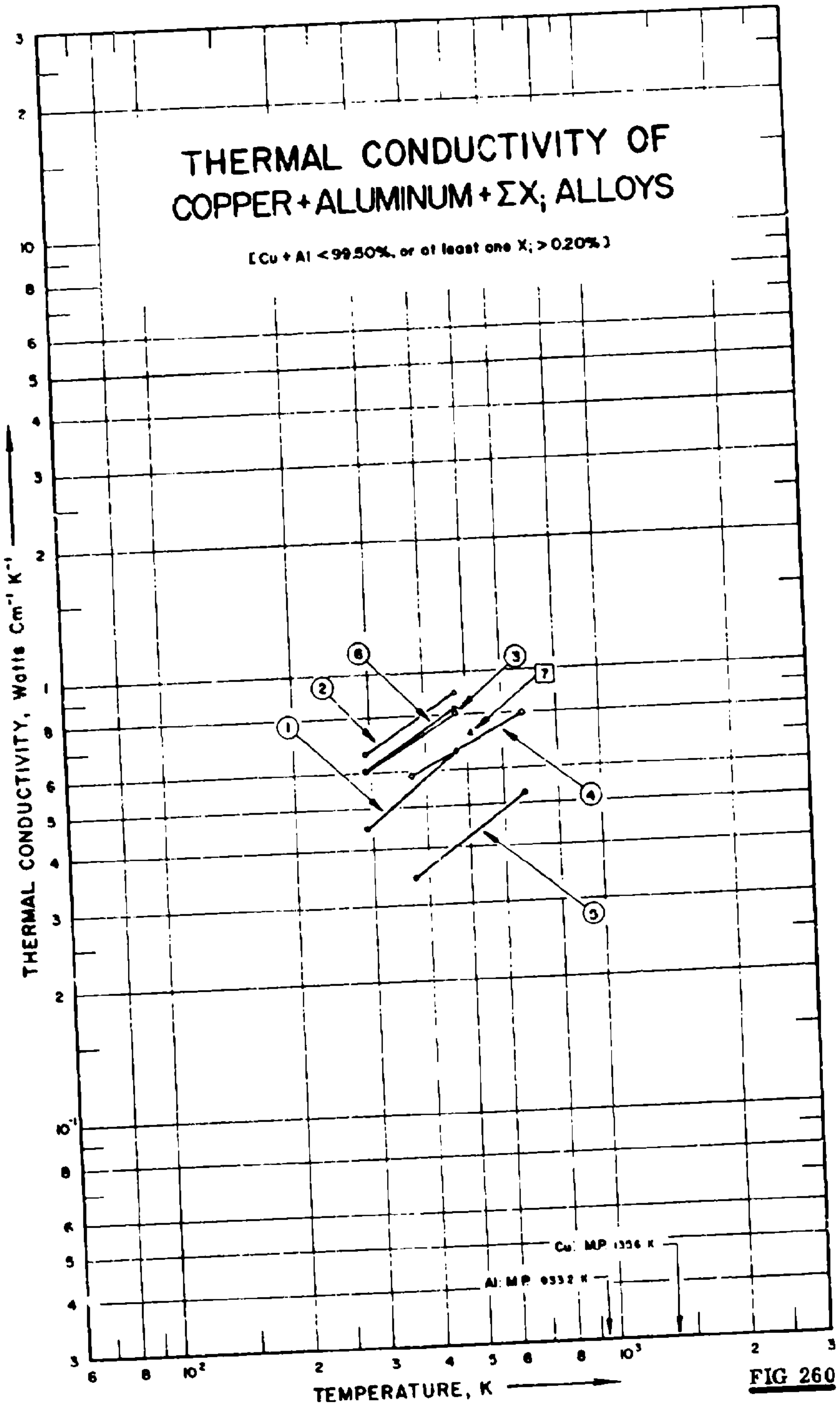

THERMAL CONDUCTIVITY OF
COPPER + ALUMINUM + ΣX; ALLOYS
[Cu + Al < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Cu: M.P. 1356 K
Al: M.P. 933.2 K
1
2
3
4
5
6
7

FIG 260

SPECIFICATION TABLE NO. 260 THERMAL CONDUCTIVITY OF [COPPER + ALUMINUM + ΣX_i] ALLOYS

(Cu + Al < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 260]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Al	Fe	Mn	Ni	Si	Sn	Composition (continued), Specifications and Remarks
1	135	L	1935	293,473		Bar 67	89.08	5.11	0.08		4.98	0.74		Quenched from 850 C.
2	135	L	1935	293,473		Bar 67 B	89.08	5.11	0.08		4.98	0.74		Annealed at 850 C.
3	135	L	1935	293,473		Bar 49	89.38	9.41	0.52		0.31		0.38	Annealed at 750 C.
4	215	L	1939	373,673	2.0	Aluminum bronze; 1	87.16	9.97	Trace	2.77				Cast.
5	215	L	1939	373,673	2.0	Aluminum bronze; 2	81.69	9.77	2.96	1.95			3.71	Cast.
6	215	L	1939	373,673	2.0	Aluminum bronze	89.56	8.66	Trace	1.75				Rolled.
7	224	L	1923	513		Aluminum bronze	89.87	9.09					0.47	

DATA TABLE NO. 260 THERMAL CONDUCTIVITY OF [COPPER + ALUMINUM + ΣX_i] ALLOYS

(Cu + Al < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
293.00	0.448
473.00	0.661
CURVE 2	
293.00	0.661
473.00	0.895
CURVE 3	
293.00	0.603
475.00	0.803
CURVE 4	
373.00	0.586
673.00	0.799
CURVE 5	
373.00	0.343
763.00	0.527
CURVE 6	
373.00	0.603
673.00	0.824
CURVE 7	
513.00	0.728

SPECIFICATION TABLE NO. 261 THERMAL CONDUCTIVITY OF [COPPER + BERYLLIUM + ΣX_i] ALLOYS $Cu + Be + \Sigma X_i$

($Cu + Be < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Be	Fe	Ni	Composition (continued), Specifications and Remarks
1	135	L	1935	293, 473		Bar 140	97.49	2.24	0.06	0.27	Quenched from 815 C.
2	135	L	1935	293, 473		Bar 141	97.49	2.24	0.06	0.27	Quenched from 815 C and followed by reheating to 300 C.

DATA TABLE NO. 261 THERMAL CONDUCTIVITY OF [COPPER + BERYLLIUM + ΣX_i] ALLOYS $Cu + Be + \Sigma X_i$

($Cu + Be < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
293.0	0.858
473.0	1.04
CURVE 2*	
293	1.03
473	1.17

* No graphic presentation

SPECIFICATION TABLE NO. 262 THERMAL CONDUCTIVITY OF [COPPER + CADMIUM + ΣX_i] ALLOYS Cu + Cd + ΣX_i

(Cu + Cd < 99.50% or at least one X_i > 0.20%)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Cd	Fe	Composition (continued), Specifications and Remarks
1	135	L	1935	293, 473		Bar 70	98.41	1.07	0.02	0.02 Si, 0.59 Sn; approx composition; annealed at 750 C for 1.5 hrs; electrical conductivity 32.74 and 23.30 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C respectively.

DATA TABLE NO. 262 THERMAL CONDUCTIVITY OF [COPPER + CADMIUM + ΣX_i] ALLOYS Cu + Cd + ΣX_i

(Cu + Cd < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1*	
293.2	2.33
473.2	2.690

*No graphical presentation

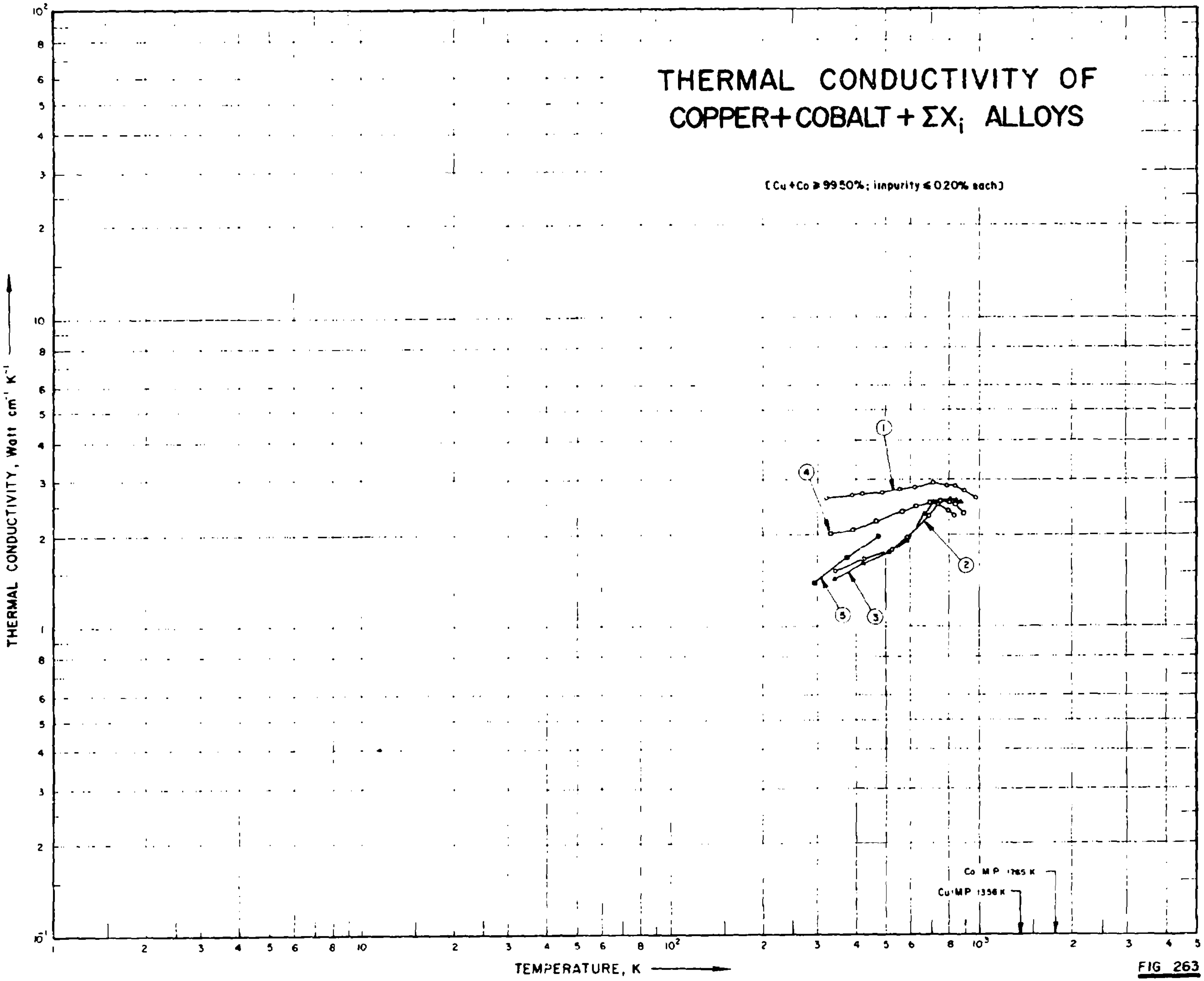

THERMAL CONDUCTIVITY OF
COPPER+COBALT+ΣXi ALLOYS
(Cu+Co ≥ 99.50%; impurity ≤ 0.20% each)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Co M.P. 1765 K
Cu M.P. 1356 K
1
2
3
4
5

FIG 263

SPECIFICATION TABLE NO. 263 THERMAL CONDUCTIVITY OF [COPPER + COBALT + ΣX_i] ALLOYS

(Cu + Co < 99.50% of at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 263]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cu	Co	Be	Ag	Zr	Composition (continued), Specifications and Remarks
							Composition (weight percent)					
1	377		1957	321-975			99.4	0.3			0.3	Electrical conductivity 33.55, 28.12, 26.35, 23.18, 20.95, 18.9, 17.1, 15.33, 14.1, 12.68 and 10.95 x 10^4 ohm^{-1} cm^{-1} at 47.25, 115.9, 145.8, 214.8, 281.8, 346.4, 436.6, 508.6, 567, 618.3 and 701.6 C, respectively.
2	377		1957	342-836			97.15	1.7	0.15	1.0		Electrical conductivity 17.48, 15.67, 13.96, 13.51, 13.75, 13.85, 12.25 and 11.30 x 10^4 ohm^{-1} cm^{-1} at 68.6, 150.3, 247.5, 314, 416.8, 467, 523 and 562.5 C, respectively.
3	377		1957	341-873			99.29	0.3			0.27	0.14 Mo; electrical conductivity 17.15, 15.41, 14.0, 13.26, 14.5, 14.53, 13.12, 12.42 and 11.8 x 10^4 ohm^{-1} cm^{-1} at 67.8, 146.7, 235.1, 313.6, 390, 438.3, 533.8, 570.6 and 600 C, respectively.
4	377		1957	330-892			97.2	2.2	~~1.0~~ 0.5			Electrical conductivity 25.0, 21.8, 19.5, 17.12, 16.13, 14.9, 14.04, 13, 12.23 and 10.86 x 10^4 ohm^{-1} cm^{-1} at 56.3, 117, 190, 291, 350, 421, 681.3, 530, 566.5 and 619 C, respectively.
5	588		1960	293-473			97.3	2.2	0.5			Normalized at 1000 C for 30 min.

DATA TABLE NO. 263 THERMAL CONDUCTIVITY OF [COPPER + COBALT + ΣX_i] ALLOYS

(Cu + Co < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		CURVE 4 (cont.)	
320.5	2.62	694.2	2.54
389.1	2.68	754.5	2.57
419.0	2.71	803.2	2.56
488.0	2.74	839.7	2.51
555.0	2.82	892.2	2.36
619.6	2.85		
709.8	2.95	CURVE 5	
781.8	2.90		
840.2	2.89	293.2	1.40
891.5	2.79	373.2	1.70
974.8	2.62	473.2	1.91
CURVE 2			
341.8	1.53		
423.5	1.67		
520.7	1.79		
587.2	1.97		
690.0	2.32		
740.2	2.52		
795.2	2.40		
835.7	2.31		
CURVE 3			
341.0	1.44		
419.9	1.61		
508.3	1.76		
586.8	1.92		
663.2	2.35		
711.5	2.55		
807.0	2.61		
843.8	2.59		
873.2	2.56		
CURVE 4			
329.5	2.03		
390.2	2.08		
463.2	2.23		
564.2	2.39		
623.2	2.48		

SPECIFICATION TABLE NO. 264 THERMAL CONDUCTIVITY OF [COPPER + IRON + ΣX_i] ALLOYS Cu + Fe + ΣX_i

(Cu + Fe < 99.50% or at least one X_i > 0.20%)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Fe	Mn	Composition (continued), Specifications and Remarks
1	135	L	1935	293, 473		Bar 137	50.75	48.6	0.47	0.047 Si, 0.023 C; annealed at 800 C.

DATA TABLE NO. 264 THERMAL CONDUCTIVITY OF [COPPER + IRON + ΣX_i] ALLOYS Cu + Fe + ΣX_i

(Cu + Fe < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
293.0	0.992
473.0	1.134

*No graphical presentation

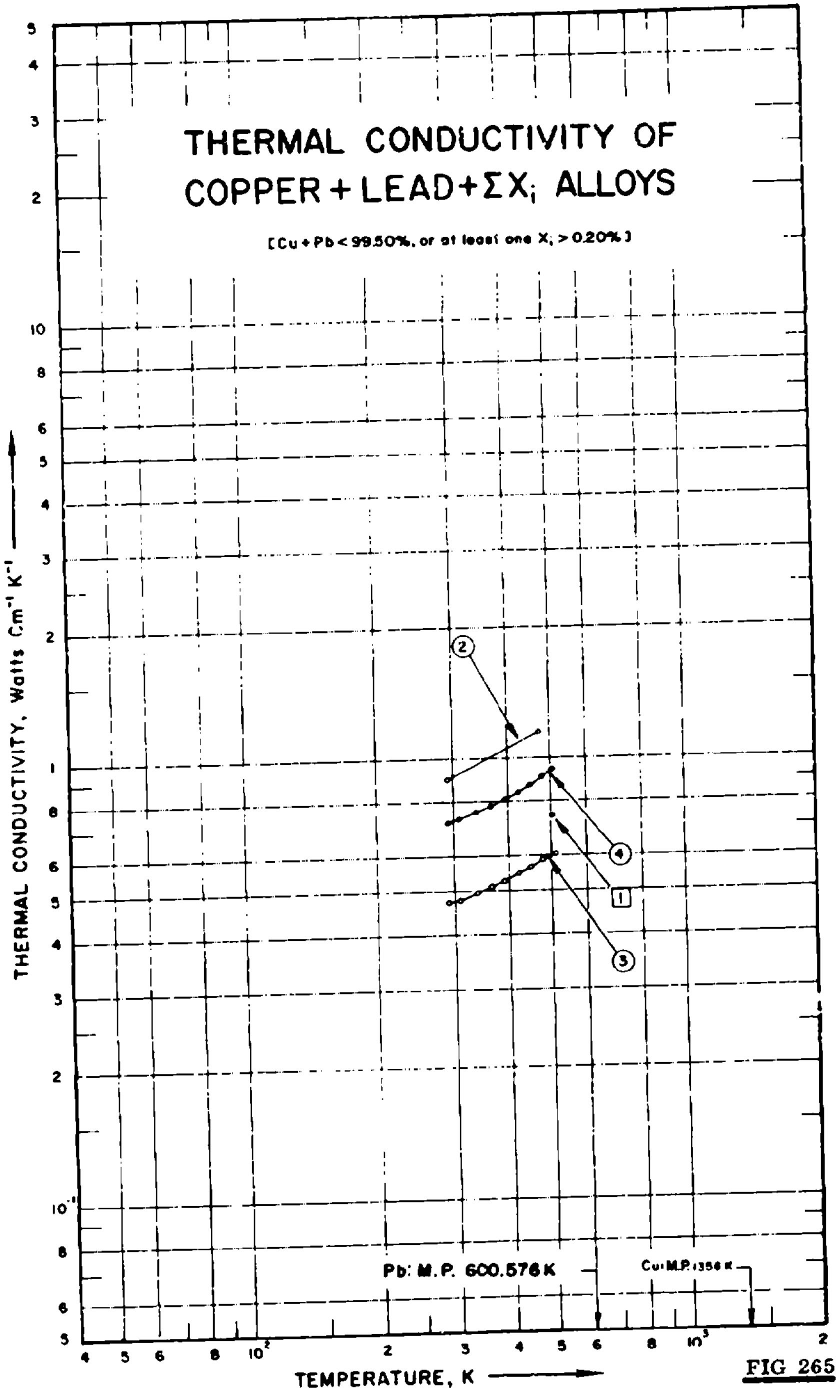

THERMAL CONDUCTIVITY OF
COPPER + LEAD + ΣX_i ALLOYS
[Cu + Pb < 99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}
TEMPERATURE, K
Pb: M.P. 600.576 K
Cu: M.P. 1356 K
1
2
3
4

FIG 265

SPECIFICATION TABLE NO. 265 THERMAL CONDUCTIVITY OF [COPPER + LEAD + ΣX_i] ALLOYS

($Cu + Pb < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 265]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cu	Pb	Sn	Zn	Si	Fe	Sb	Composition (continued), Specifications and Remarks
1	224	L	1923	503.2		SAE Bearing alloy - No. 66	85.29	8.26	5.56	0.89				
2	135	L	1935	293, 473		Bar 98	88.07	3.83	3.77	3.7	0.6	0.03		Annealed at 700 C for 2 hrs; electrical conductivity 11.53 and 9.89×10^4 ohm^{-1} cm^{-1} at 20 and 200 C, respectively.
3	529	C	1958	292-504	±5	80-10-10	79.0	10.2	9.3	0.27	0.43	0.01	0.26	0.01 P; average composition; density 8.93 g cm^{-3}; M.P. 929 C; electrical resistivity reported 17.01, 17.63, 18.00, 18.38, 18.76, 19.15, 19.53 and 19.92 μohm cm at 20, 66, 93, 121, 149, 177, 204, and 232 C, respectively.
4	529	C	1958	292-504	±5	85-5-5-5	85.0	5.1	4.4	4.6	0.7	0.11	0.17	0.01 P; average composition; density 8.92 g cm^{-3}; M.P. 1009 C; electrical resistivity reported 11.43, 11.87, 12.13, 12.42, 12.70, 12.99, 13.28 and 13.59 μohm cm at 20, 66, 93, 121, 149, 177, 204 and 232 C, respectively.

DATA TABLE NO. 265 THERMAL CONDUCTIVITY OF [COPPER + LEAD + ΣX_i] ALLOYS

(Cu + Pb > 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
503.2	0.741
CURVE 2	
293.2	0.900
473.2	1.155
CURVE 3	
292.2	0.476
309.9	0.479
337.7	0.498
365.5	0.514
393.3	0.530
421.1	0.549
448.8	0.568
476.6	0.588
504.4	0.613
CURVE 4	
292.2	0.720
309.9	0.734
337.7	0.758
365.5	0.782
393.3	0.810
421.1	0.839
448.8	0.871
476.6	0.909
504.4	0.945

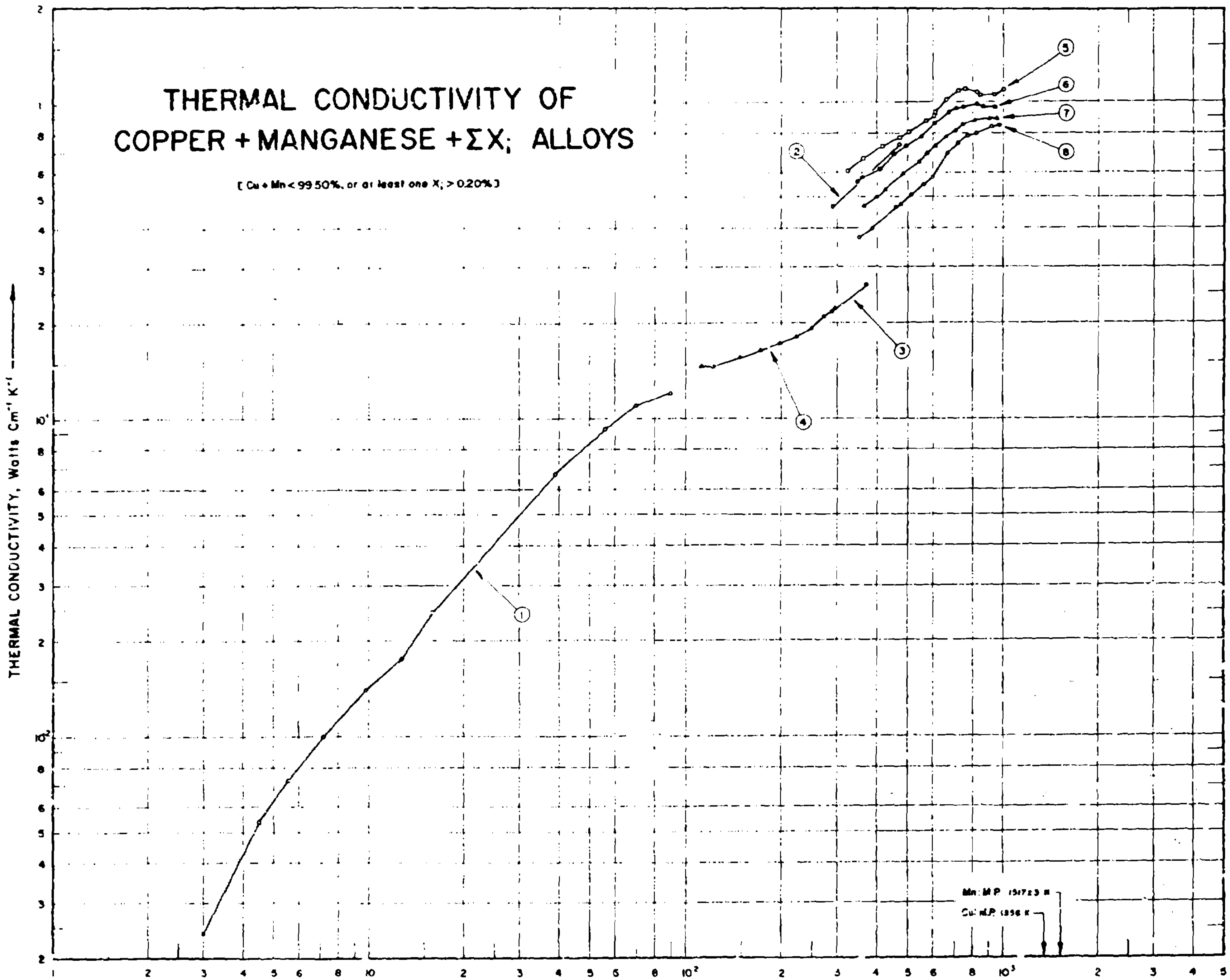

THERMAL CONDUCTIVITY OF
COPPER + MANGANESE + ΣX; ALLOYS
[Cu + Mn < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Mn: M.P. 1517±3 K
Cu: M.P. 1356 K
1
2
3
4
5
6
7
8

FIG 266

SPECIFICATION TABLE NO. 266 THERMAL CONDUCTIVITY OF [COPPER + MANGANESE + ΣX_i] ALLOYS

(Cu + Mn < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 266]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Mn	Ni	Be	Composition (continued), Specifications and Remarks
1	154	L	1956	3.0-90	< 5	Manganin NM Mis	85.0	12.0	3.0		NMMTs manganin; specimen 3 mm in dia; unannealed.
2	135	L	1935	293, 473		Bar 64	95.61	4.51			0.11 Fe; annealed at 700 C; electrical conductivity 5.95 and 5.793 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C, respectively.
3	77	E	1900	291, 373		Manganin	84.0	12.0	4.0		Specimen 1.806 cm in dia and 27 cm long; drawn; density 8.44 g cm^{-3}.
4	88	L	1908	113-295		Manganin	84.0	12.0	4.0		Turned from a bar; density 8.42 g cm^{-3} at 22 C.
5	586		1958	326-1014			95.45	3.65		0.9	Annealed after heating in vacuum at 300 C for 6 hrs.
6	586		1958	348-946			93.63	5.47		0.9	Similar to the above specimen.
7	586		1958	362-963			91.8	7.3		0.9	Similar to the above specimen.
8	586		1958	353-981			89.91	9.12			Similar to the above specimen.

DATA TABLE NO. 266 THERMAL CONDUCTIVITY OF [COPPER + MANGANESE + ΣX_i] ALLOYS

[Cu + Mn ≥ 99.50% or at least one X_i > 0.20%]

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k	T	k	T	k
CURVE 1		CURVE 5 (cont.)		CURVE 8	
3.00	0.00229	507.2	0.803	353.2	0.372
4.50	0.00536	578.2	0.870	389.2	0.397
5.36	0.00724	620.2	0.899	461.2	0.464
7.20	0.00996	615.2	0.925	478.2	0.47[illegible]
9.8[illegible]	0.0140	661.2	1.01	516.2	0.506
12.8	0.0176	727.2	1.08	564.2	0.548
16.0	0.0243	766.2	1.09	600.2	0.577
29.0	0.0664	818.2	1.07	672.2	0.690
50.0	0.0921	856.2	1.06	725.2	0.741
70.0	0.110	945.2	1.05	778.2	0.787
90.0	0.123	1014.2	1.10	828.2	0.795
				928.2	0.8[illegible]
CURVE 2		CURVE 6		981.2	0.815
293.0	0.464	348.2	0.556		
473.0	0.736	363.2	0.577		
		412.2	0.615		
CURVE 3		434.2	0.656		
		490.2	0.728		
291.2	0.217	551.2	0.782		
373.2	0.264	617.2	0.858		
		657.2	0.925		
CURVE 4		717.2	0.951		
		752.2	0.967		
113.2	0.146	813.2	0.97[illegible]		
123.2	0.146	870.2	0.967		
148.2	0.155	916.2	0.962		
173.2	0.163				
198.2	0.172	CURVE 7			
223.2	0.180				
248.2	0.192	362.2	0.460		
273.2	0.20[illegible]	391.2	0.498		
291.2	0.218	426.2	0.527		
295.2	0.221	487.2	0.594		
		542.2	0.64[illegible]		
CURVE 5		577.2	0.686		
		611.2	0.728		
326.2	0.607	661.2	0.774		
365.2	0.665	708.2	0.812		
418.2	0.724	749.2	0.84[illegible]		
473.2	0.770	816.2	0.874		
		901.2	0.887		
		963.2	0.887		

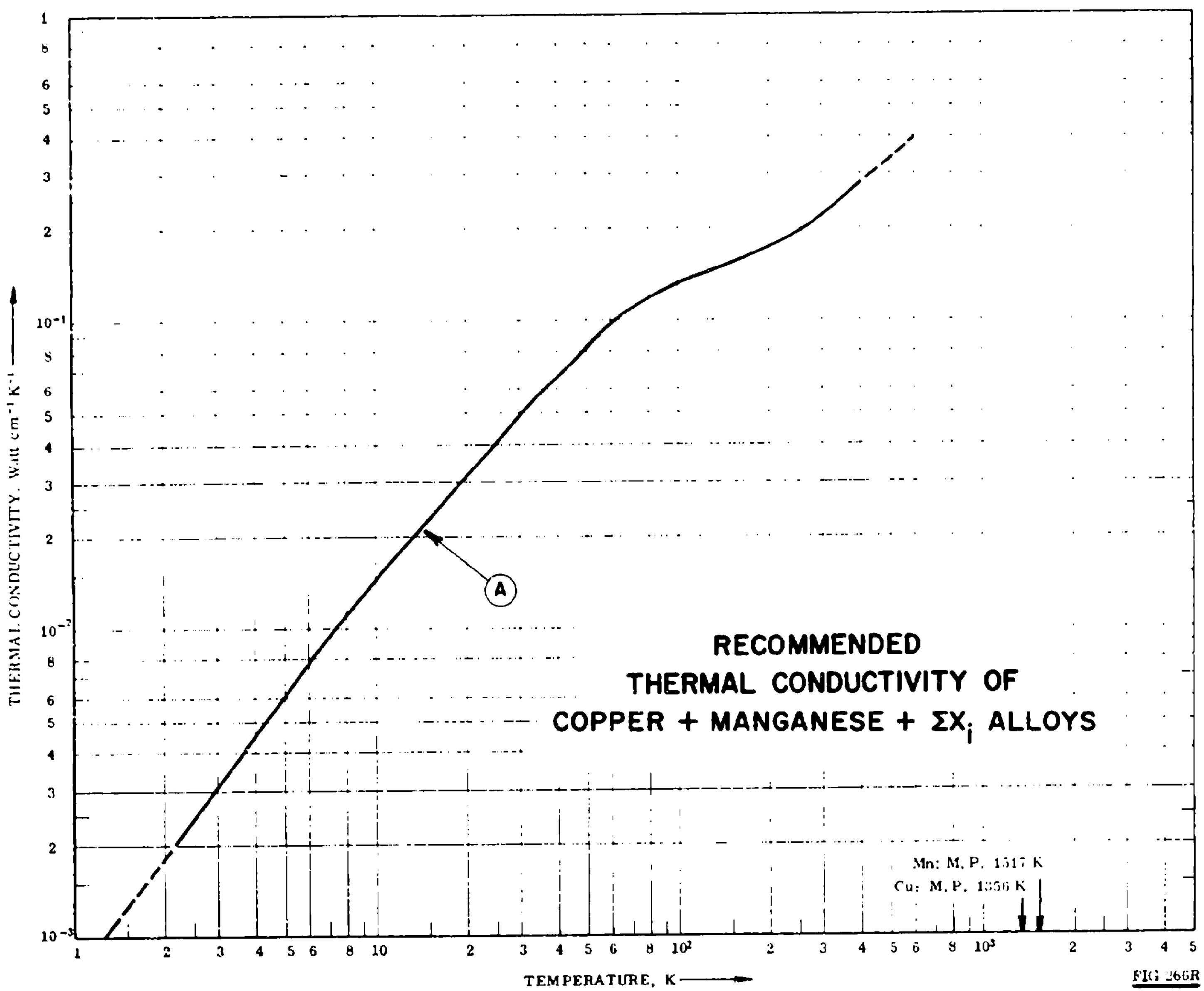

RECOMMENDED
THERMAL CONDUCTIVITY OF
COPPER + MANGANESE + ΣX$_i$ ALLOYS
A
Mn: M. P. 1517 K
Cu: M. P. 1356 K
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
1
8
6
5
4
3
2
10^{-1}
10^{-2}
10^{-3}
10
10^2
10^3

FIG 266R

SPECIFICATION TABLE NO. 266R RECOMMENDED THERMAL CONDUCTIVITY OF [COPPER + MANGANESE + ΣX_i] ALLOYS

[For Data Reported in Figure and Data Table No. 266R]

Curve No.	Name and Designation	Nominal Composition (weight percent) and Remarks	Estimated Error
A	Manganin	84 Cu, 12 Mn, and 4 Ni	±5% near room temperature and ±5 to ±10% at other temperatures.

DATA TABLE NO. 266R RECOMMENDED THERMAL CONDUCTIVITY OF [COPPER + MANGANESE + ΣX_i] ALLOYS

[Temperature, T_1 in K and T_2 in F; Thermal Conductivity, k_1 in Watt $cm^{-1} K^{-1}$ and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$]

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
	CURVE A				CURVE A (cont.)				CURVE A (cont.)		
0	0	0	-459.7	15	0.0232	1.34	-432.7	100	0.133	7.68	-279.7
1	(0.0007)‡	(0.0404)	-457.9	16	0.0250	1.44	-430.9	150	0.156	9.01	-189.7
2	(0.0018)	(0.104)	-456.1	18	0.0285	1.65	-427.3	200	0.172	9.94	- 99.7
3	0.0031	0.179	-454.3	20	0.0322	1.86	-423.7	250	0.193	11.2	- 9.7
4	0.0046	0.266	-452.5	25	0.0410	2.37	-414.7	273.2	0.206	11.9	32.0
5	0.0062	0.358	-450.7	30	0.0497	2.87	-405.7	300	0.222	12.8	80.3
6	0.0078	0.451	-448.9	35	0.0583	3.37	-396.7	350	0.250	14.4	170.3
7	0.0095	0.549	-447.1	40	0.067	3.87	-387.7	400	(0.279)	(16.1)	260.3
8	0.0111	0.641	-445.3	45	0.075	4.33	-378.7	500	(0.338)	(19.5)	440.3
9	0.0128	0.740	-443.5	50	0.082	4.74	-369.7	600	(0.397)	(22.9)	620.3
10	0.0145	0.838	-441.7	60	0.097	5.60	-351.7				
11	0.0162	0.936	-439.9	70	0.110	6.36	-333.7				
12	0.0180	1.04	-438.1	80	0.120	6.93	-315.7				
13	0.0197	1.14	-436.3	90	0.127	7.34	-297.7				
14	0.0215	1.24	-434.5								

‡ Values in parentheses are extrapolated.

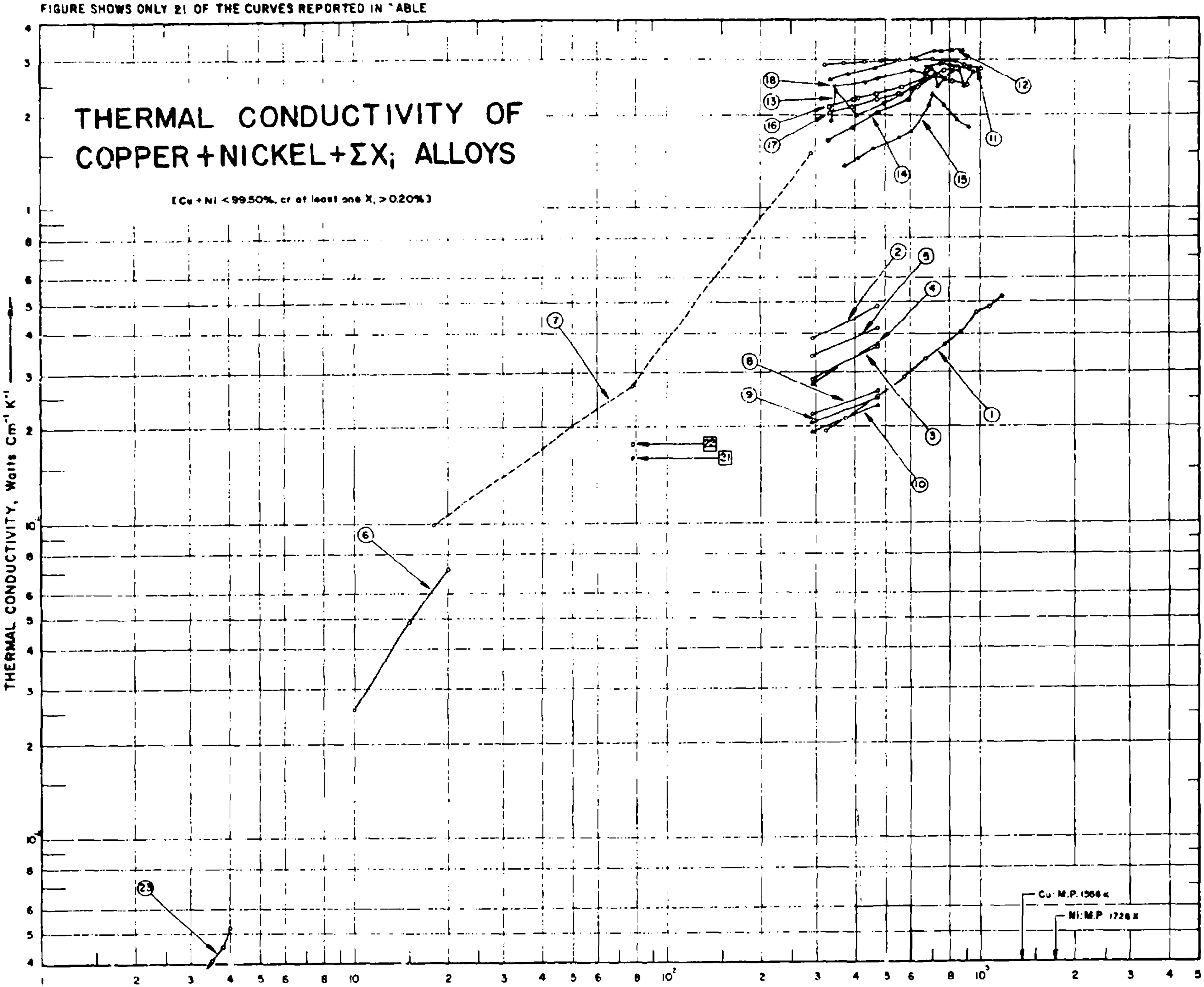


FIGURE SHOWS ONLY 21 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
COPPER + NICKEL + ΣX; ALLOYS
[Cu + Ni < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Cu: M.P. 1356 K
Ni: M.P. 1726 K

FIG 267

SPECIFICATION TABLE NO. 267 THERMAL CONDUCTIVITY OF [COPPER + NICKEL + ΣX_i] ALLOYS

(Cu + Ni < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 267]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cu	Ni	C	Fe	Mn	Pb	Si	Sn	Zn	Composition (continued), Specifications and Remarks
							Composition (weight per cent)									
1	131	C	1953	323-1173	2.0	Advance	54.79	44.04	0.035		1.2		0.003			Annealed at 900 C.
2	135	L	1935	293,473		Bar 32	74.07	19.96		0.09	0.57				5.31	Annealed at 700 C.
3	135	L	1935	293,473		Bar 35	64.15	29.44		0.07	0.52				5.69	Annealed at 700 C.
4	135	L	1935	293,473		Bar 6	63.37	19.89		0.14	0.23	5.4		3.31	9.22	Sand-cast.
5	135	L	1935	293,473		Bar 23	64.14	18.38	0.023	0.19	0.3				17.06	Annealed at 750 C.
6	152	L	1949	10-20			63.0	20.0							17.0	Severely cold-worked.
7	193	L	1939	18-290		Cupronickel	77.44	20.48							1.99	
8	531	L	1936	293,473		5	62.16	20.22	0.012	0.05	0.13	0.005	0.003	trace	17.44	0.005 S; cast and machined.
9	531	L	1936	293,473		6	61.96	25.56	0.02	0.07	0.10	0.004	0.004	trace	12.13	0.005 S; cast and machined.
10	531	L	1936	293,473		7	62.02	29.77	0.019	0.09	0.14	0.003	0.007	trace	7.93	0.002 S; cast and machined.
11	377		1957	321-1002			99.03	0.6								0.27 Zr, 0.1 P.
12	377		1957	334-884			98.99	0.6						0.15		0.26 Zr.
13	378		1957	336-948			99.0	0.8								0.2 Ti.
14	378		1957	329-774			98.85	0.9								0.25 P.
15	378		1957	370-920			98.5	1.2					0.3			
16	378		1957	331-815			98.73	0.8								0.33 Zr, 0.14 Be.
17	378		1957	333-910			98.53	1.0								0.33 Zr, 0.14 Be.
18	378		1957	345-923			99.28	0.55								0.17 Zr.
19	378		1957	326-974			99.13	0.62								0.25 Zr.
20	378		1957	333-855			99.3	0.28								0.24 Zr, 0.18 Be.
21	433	L	1940	78.2		6	50.153	49.451		0.06	0.05	trace				0.264 Co, 0.01 Al, 0.008 Sb, 0.004 S; calculated composition.
22	433	L	1949	78.2		7	60.08	39.6		0.066	0.02	trace				0.211 Co, 0.008 Al, 0.009 Sb, 0.004 S; calculated composition.
23	532	L	1960	0.28-4.0		Cupronickel	69.6	30.0		0.40						Nominal composition; annealed and drawn to a 30% reduction in area from super-nickel 702 supplied by Anaconda.

DATA TABLE NO. 267 THERMAL CONDUCTIVITY OF [COPPER + NICKEL + ΣX_i] ALLOYS

(Cu + Ni < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
323.2	0.194
373.2	0.212
473.2	0.251
573.2	0.289
673.2	0.328
773.2	0.367
873.2	0.405
973.2	0.403
1073.2	0.481
1173.2	0.520

CURVE 2

T	k
293.2	0.385
473.2	0.485

CURVE 3

T	k
293.2	0.285
473.2	0.360

CURVE 4

T	k
293.2	0.276
473.2	0.368

CURVE 5

T	k
293.2	0.335
473.2	0.418

CURVE 6

T	k
10.0	0.0255
15.0	0.0485
20.0	0.0711

CURVE 7

T	k
18.0	0.0987
78.0	0.272
290.0	1.490

CURVE 8

T	k
293.2	0.218
473.2	0.264

CURVE 9

T	k
293.2	0.205
473.2	0.251

CURVE 10

T	k
293.2	0.192
473.2	0.234

CURVE 11

T	k
320.5	2.87
367.2	2.90
428.7	2.94
484.2	2.95
556.7	2.97
627.5	2.97
705.3	2.99
767.0	2.94
833.7	2.94
889.5	2.87
928.3	2.84
1002.2	2.77

CURVE 12

T	k
334.2	2.57
379.7	2.67
466.2	2.79
554.7	2.97*
604.5	3.03
715.2	3.13
755.2	3.18
817.2	3.19
884.2	3.20

CURVE 13

T	k
336.0	1.91
346.8	2.38
404.1	1.99
490.7	2.16
563.8	2.31
713.5	2.66
735.7	2.42
811.5	2.73
853.5	2.75
891.2	2.45
947.5	2.73

CURVE 14

T	k
329.2	1.64
392.0	1.81
474.2	2.03
589.2	2.23
695.2	2.77
773.7	2.56

CURVE 15

T	k
369.8	1.36
408.8	1.43
458.0	1.54
552.2	1.67
606.3	1.76
686.2	2.15
702.2	2.31
766.5	2.14
843.2	1.92
919.8	1.83

CURVE 16

T	k
331.2	2.12
396.2	2.23
409.2	2.25
469.0	2.31
563.5	2.43
678.8	2.60
766.2	2.75
815.2	2.79

CURVE 17

T	k
333.2	2.03
390.2	2.11
469.0	2.22
555.2	2.31
627.5	2.44
715.2	2.65
818.0	2.51
910.2	2.48

CURVE 18

T	k
345.0	2.45
431.9	2.52
474.2	2.59
604.2	2.74
664.2	2.67
674.6	2.82
746.8	2.88
808.0	2.84
848.2	2.82
922.7	2.76

CURVE 19*

T	k
325.8	2.38
404.7	2.48
498.6	2.61
598.5	2.74
677.0	2.90
709.1	2.97
807.1	2.97
908.9	2.93
974.3	2.85

CURVE 20*

T	k
333.0	2.15
392.7	2.21
490.0	2.35
575.8	2.45
656.2	2.49
728.3	2.57

CURVE 20(cont.)*

T	k
795.2	2.61
854.8	2.54

CURVE 21

T	k
78.2	0.162

CURVE 22

T	k
78.2	0.178

CURVE 23

T	k
0.275	0.000171*
0.325	0.000240*
0.355	0.000250*
0.400	0.000295*
0.440	0.000310*
0.460	0.000360*
0.475	0.000400*
[illegible]	0.000695*
0.930	0.000800*
1.07	0.000990*
1.51	0.00150*
1.70	0.00173*
1.85	0.00195*
2.05	0.00210*
2.40	0.00255*
2.85	0.00310*
3.50	0.00410
3.80	0.00450
4.00	0.00520

* Not shown on plot

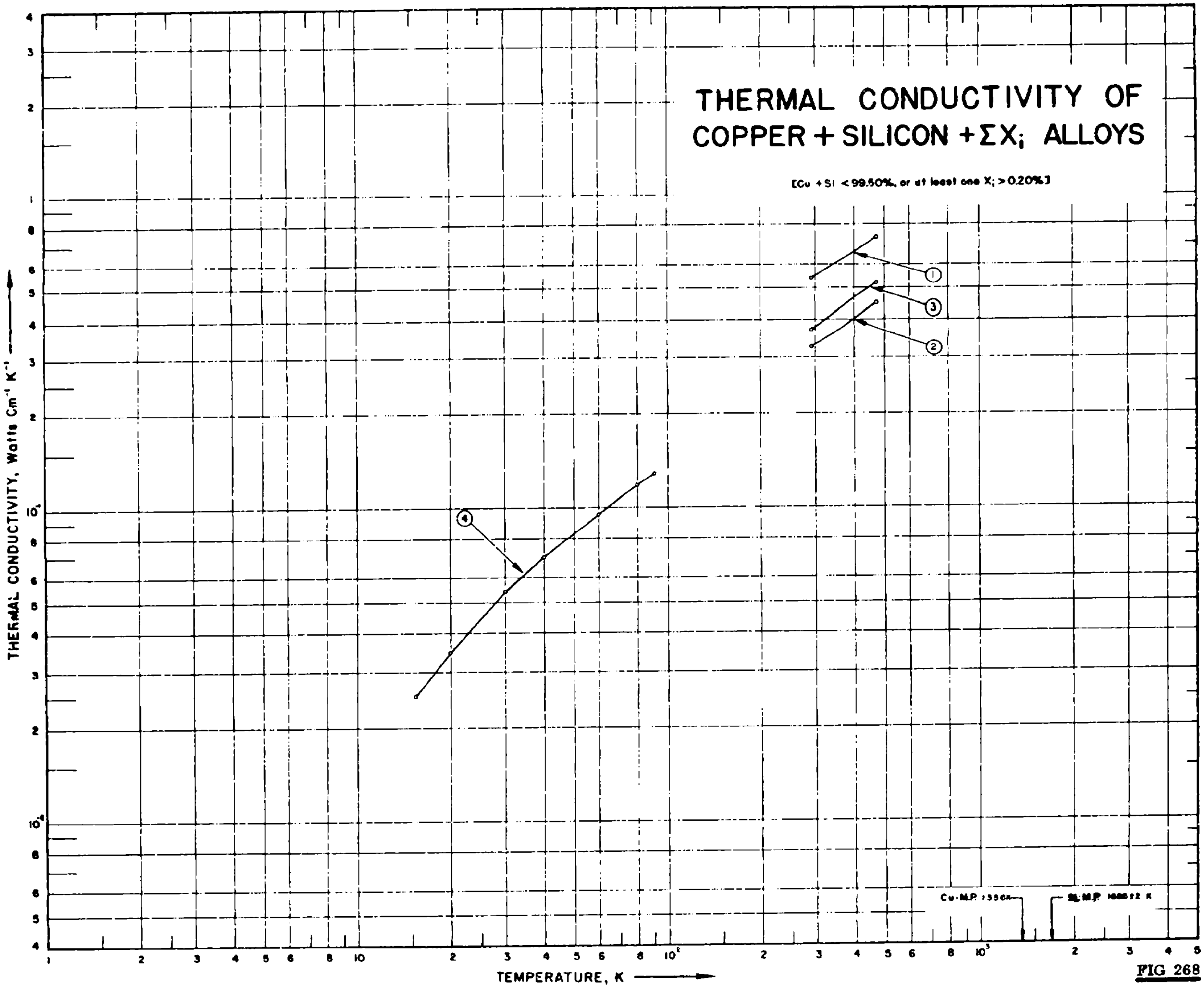

THERMAL CONDUCTIVITY OF
COPPER + SILICON + ΣX; ALLOYS
[Cu + Si < 99.50%, or at least one X; > 0.20%]
1
2
3
4
Cu M.P. 1356 K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 268

SPECIFICATION TABLE NO. 268 THERMAL CONDUCTIVITY OF [COPPER + SILICON + ΣX_i] ALLOYS

(Cu + Si < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 268]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Si	Fe	Mn	Zn	Composition (continued), Specifications and Remarks
1	135	L	1935	293, 473		Bar 136	98.1	1.5	0.06	0.3		Annealed at 700 C for 2 hrs; electrical conductivity 6.611 and 6.022 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C, respectively.
2	135	L	1935	293, 473		Bar 72	95.69	3.23	0.16	0.99		Annealed at 750 C for 1-1/2 hrs; electrical conductivity 3.773 and 3.611 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C, respectively.
3	135	L	1935	293, 473		Bar 135	95.83	3.11	0.02		1.12	Annealed at 700 C for 2 hrs; electrical conductivity 4.586 and 4.228 x 10^4 ohm^{-1} cm^{-1} at 20 and 200 C, respectively.
4	432	L	1957	16-91		Silicon bronze-A	≈94.72	3.15	0.001	1.13	1.0	0.001 each Cd, Cr, Ag, 0.001 >each B, Ca, Al, Pb, Sn; turned and ground from a hard temper rod.

DATA TABLE NO. 268 THERMAL CONDUCTIVITY OF [COPPER + SILICON + ΣX_i] ALLOYS

(Cu + Si < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
293.2	0.540
473.2	0.732
CURVE 2	
293.2	0.226
473.2	0.448
CURVE 3	
293.2	0.372
473.2	0.518
CURVE 4	
15.5	0.0250
20.0	0.0345
30.0	0.0540
40.0	0.0695
60.0	0.095
80.0	0.117
91.0	0.128

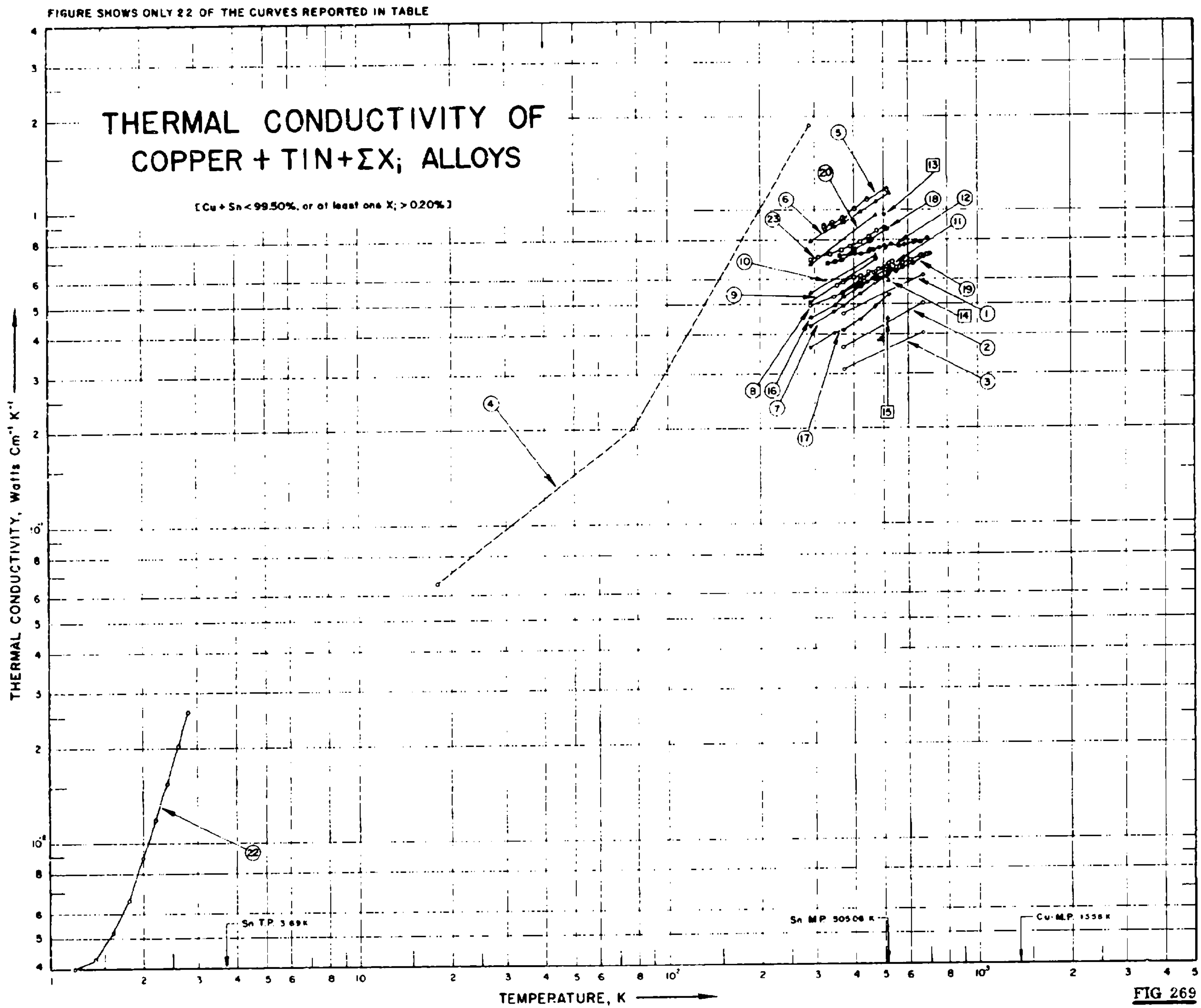


FIGURE SHOWS ONLY 22 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
COPPER + TIN + ΣXᵢ ALLOYS
[Cu + Sn < 99.50%, or at least one Xᵢ > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Sn T.P. 3.69 K
Sn M.P. 505.06 K
Cu M.P. 1358 K

FIG 269

SPECIFICATION TABLE NO. 269 THERMAL CONDUCTIVITY OF [COPPER + TIN + ΣX_i] ALLOYS

($Cu + Sn < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 269]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Sn	Fe	Ni	P	Pb	Zn	Composition (continued), Specifications and Remarks
1	215	L	1939	373, 673	2.0	1	87.93	5.44		4.96			1.65	Cast.
2	215	L	1939	373, 673	2.0	2	73.28	16.06		9.67			0.99	Cast.
3	215	L	1939	373, 673	2.0	3	58.0	30.71		10.29			1.0	Cast.
4	193	L	1939	18-290		Phosphor Bronze	84.89	13.07			0.013	0.16	1.86	
5	134	L	1931	324-512	2.0	42	≈94.02	4.88	0.03		0.06	1.16		Annealed at 650 C.
6	55	F	1928	293-523		Bronze; bar 1	92.8	5.0			0.15		2.0	
7	55	F	1928	293-523		Bronze; bar 2	87.8	10.0			0.15		2.0	
8	55	F	1928	293-523		Bronze; bar 5	88.0	10.0					2.0	
9	135	F	1935	293, 473		Bar 15 A	88.36	9.55	0.07				1.9	Sand-cast.
10	135	F	1935	293, 473		Bar 9	87.86	8.87	0.03				3.05	Sand-cast.
11	30	L	1925	357-692	< 2.0	Admiralty Gun-Metal	87.24	10.02	0.21			0.35	2.18	Cast.
12	30	L	1925	361-692	< 2.0	Gun-Metal (ordinary)	85.05	8.72	0.21			0.98	5.04	Cast.
13	224	L	1923	506		SAE Bearing Alloy No. 40	84.93	5.14				5.01	4.92	
14	224	L	1923	521		SAE Bearing Alloy No. 62	86.6	10.55				0.04	2.81	
15	224	L	1923	518		SAE Bearing Alloy No. 64	79.04	10.83			0.3	9.55		
16	55	F	1928	293-523		Phosphor bronze; bar 3	91.7	8.0			0.3			
17	55	F	1928	293-523		Bronze; bar 6	87.2	12.4			0.4			Annealed at 650 C.
18	134	L	1931	331-514	2.0	40	≈95.56	4.18	0.01		0.33	0.04		
19	30	L	1925	368-704	2.0	Phosphor Bronze	87.82	11.28	0.17		0.35			Cast.
20	516	L	1941	293, 473		Phosphor bronze; 2	96.5	3.09	0.01	0.01	0.39	< 0.005		< 0.005 Sb; cast, after air cooling annealed at 625 C, cold-rolled; machined.
21	516	L	1941	293, 473		Phosphor bronze; 4	92.2	7.41	0.02		0.38	0.01		< 0.005 Sb; cast, after air cooling annealed at 625 C, hot-rolled at 300 C and annealed for 2.5 hrs at 625 C, and again hot rolled at 300 C and annealed for 2.5 hrs at 625 C, and then cold-rolled and machined.
22	530	L	1954	1.2-2.8	< 10	Phosphor Bronze								Composition not reported; in wire form, 40 μ in dia.

SPECIFICATION TABLE NO. 269 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Sn	Fe	Ni	P	Pb	Zn	Composition (continued), Specifications and Remarks
23	529	C	1958	292-504	± 5.0	Navy "M"	88.0	5.7	0.07	0.6	0.01	1.4	4.4	0.13 Sb; average composition; density 8.64 g cm^{-3}; M.P. 988 C; electrical resistivity 12.04, 12.46, 12.71, 12.97, 13.22, 13.48, 13.74, and 13.99 μohm cm at 20, 66, 93, 121, 149, 177, 204, and 232 C, respectively.

DATA TABLE NO. 269 THERMAL CONDUCTIVITY OF [COPPER + TIN + ΣX_i] ALLOYS

(Cu + Sn < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
373.2	0.464
673.2	0.619
CURVE 2	
373.2	0.364
673.2	0.502
CURVE 3	
373.2	0.310
673.2	0.402
CURVE 4	
18	0.0653
78	0.201
290	1.883
CURVE 5	
324.2	0.883
324.2	0.887
325.2	0.866
341.2	0.908
342.2	0.912
342.2	0.891
359.2	0.937
360.2	0.941
361.2	0.921
404.2	1.000
404.2	1.004
454.2	1.075
454.2	1.079
512.2	1.172
512.2	1.167
CURVE 6	
293.2	0.791
348.2	0.870
373.2	0.908
423.2	0.963
473.2	1.059
CURVE 6(cont.)	
523.2	1.138
CURVE 7	
293.2	0.427
348.2	0.473
373.2	0.494
423.2	0.540
473.2	0.582
523.2	0.626
CURVE 8	
293.2	0.494
348.2	0.527
373.2	0.548
423.2	0.594
473.2	0.636
523.2	0.678
CURVE 9	
293.2	0.502
473.2	0.695
CURVE 10	
293.2	0.540
473.2	0.716
CURVE 11	
356.7	0.573
373.7	0.585
402.2	0.607
425.7	0.615
433.7	0.603
449.7	0.632
466.2	0.636
487.2	0.649
512.2	0.649
514.7	0.657
534.2	0.686
551.2	0.657
CURVE 11(cont.)	
578.2	0.678
621.7	0.690
660.2	0.715
691.7	0.720
CURVE 12	
361.2	0.715
391.7	0.724
406.7	0.728
425.7	0.724
450.7	0.732
455.7	0.749
467.2	0.741
488.7	0.753
508.2	0.766
509.7	0.757
529.7	0.774
561.7	0.762
585.2	0.770
628.7	0.782
659.7	0.787
691.7	0.808
CURVE 13	
506.0	0.982
CURVE 14	
521.0	0.594
CURVE 15	
518.0	0.456
CURVE 16	
293.2	0.452
348.2	0.498
373.2	0.523
423.2	0.569
473.2	0.615
523.2	0.661
CURVE 17	
293.2	0.364
348.2	0.402
373.2	0.414
423.2	0.448
473.2	0.490
523.2	0.536
CURVE 18	
331.2	0.678
350.2	0.686
369.2	0.695
404.2	0.736
405.2	0.749
454.2	0.795
456.2	0.799
514.2	0.864
CURVE 19	
367.7	0.540
403.2	0.569
415.2	0.577
425.2	0.577
445.7	0.586
463.2	0.603
477.2	0.598
488.2	0.603
514.2	0.615
519.7	0.636
537.2	0.649
550.2	0.636
578.2	0.657
628.2	0.674
674.7	0.711
704.2	0.728
CURVE 20	
293.2	0.669
473.2	0.962
CURVE 21*	
293.2	0.460
473.2	0.628
CURVE 22	
1.2	0.0040
1.4	0.0043
1.6	0.0052
1.8	0.0066
2.0	0.0089
2.2	0.0118
2.4	0.0154
2.6	0.0202
2.8	0.0260
CURVE 23	
292.2	0.696
309.9	0.704
337.7	0.722
365.5	0.741
393.3	0.762
421.1	0.787
448.8	0.819
476.6	0.855
504.4	0.872

* Not shown on plot

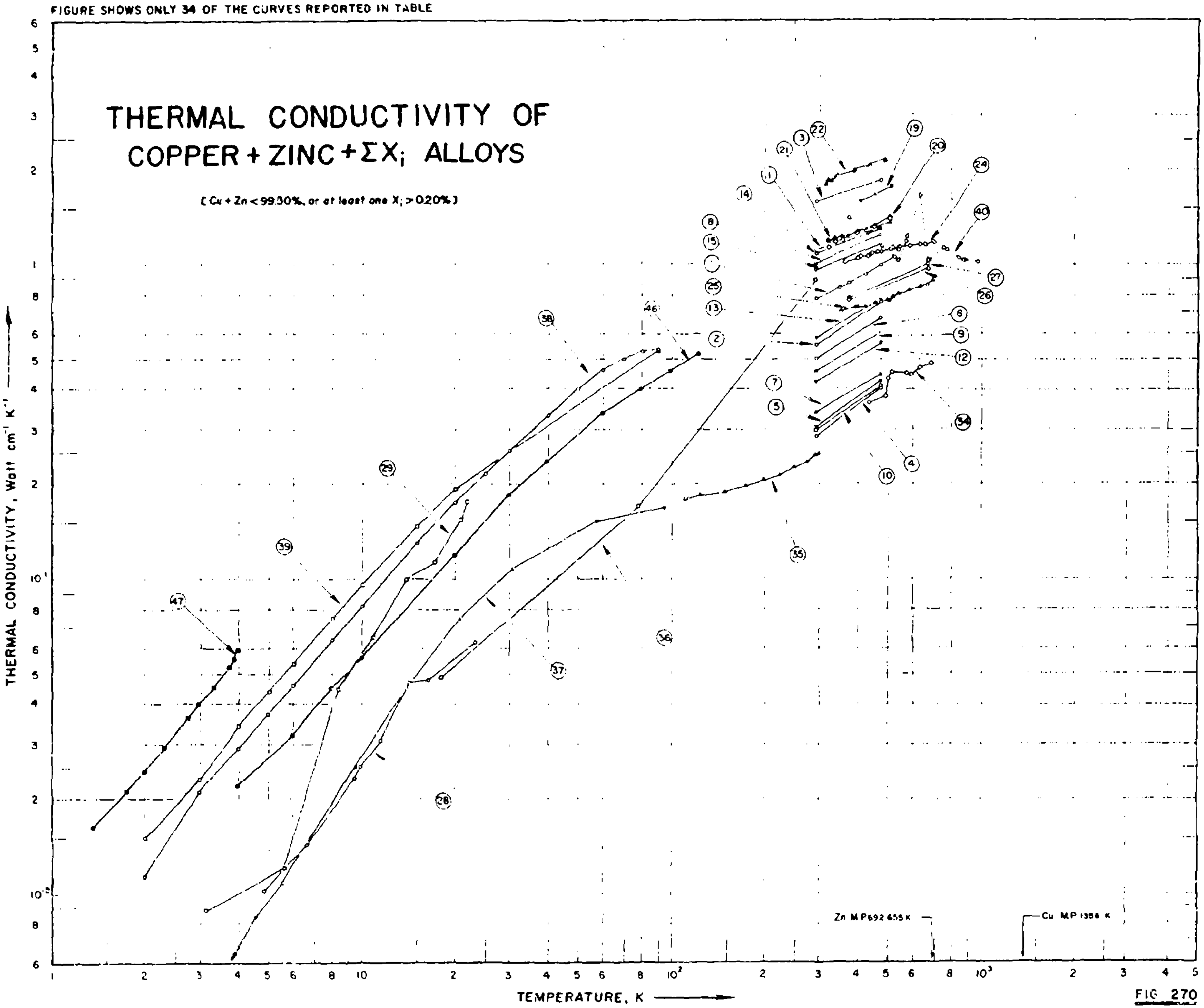


FIGURE SHOWS ONLY 34 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
COPPER + ZINC + ΣXᵢ ALLOYS
[Cu + Zn < 99.30%, or at least one Xᵢ > 0.20%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Zn M.P. 692.655 K
Cu M.P. 1356 K

FIG. 270

SPECIFICATION TABLE NO. 270 THERMAL CONDUCTIVITY OF [COPPER + ZINC + ΣX_i] ALLOYS

($Cu + Zn < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 270]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cu	Zn	Al	Fe	Mn	Ni	Pb	Sn	Composition (continued) Specifications and Remarks
1	55	P L	1928	293-523		Bronze; bar 4	60.7	38.5			0.3			0.5	
2	135	P L	1935	293, 473		Bar 133	88.08	4.09		0.02			3.8	3.76	0.25 P; annealed at 700 C.
3	135	L	1935	293, 473		Bar 97	85.1	12.97		0.05			1.88		Annealed at 700 C.
4	135	L	1935	293, 473		Bar 131	81.55	14.21		0.04	0.2				4.0 Si; chill cast.
5	135	L	1935	293, 473		Bar 5	≈56.57	17.65		0.1		13.24	10.44	2.23	Sand-cast.
6	135	L	1935	293, 473		Bar 60	72.49	17.76	4.44	1.78	3.34				Annealed at 650 C.
7	135	L	1935	293, 473		Bar 28	≈63.76	19.79		0.14	0.18	16.29			Annealed at 750 C.
8	135	L	1935	293, 473		Bar 122	75.79	22.22	1.98	0.01					Annealed at 750 C.
9	135	L	1935	293, 473		Bar 26	65.51	23.86		0.08	0.18	10.36			0.011 C; annealed at 750 C.
10	135	L	1935	293, 473		Bar 24	56.01	25.93		0.08		17.95			
11	135	L	1935	293, 473		Bar 129	65.99	29.18		0.01		0.8	4.02		Annealed at 700 C.
12	135	L	1935	293, 473		Bar 126	59.76	29.88		0.04	0.15	10.13			0.04 Mg; annealed at 700 C.
13	135	L	1935	293, 473		Bar 127	64.04	30.5		0.05		5.41			Annealed at 700 C.
14	135	L	1935	293, 473		Bar 96	61.65	34.79		0.07			3.29		
15	135	L	1935	293, 473		Bar 10	60.54	36.46	0.04	0.73	0.21			1.48	Sand-cast.
16	135	L	1935	293, 473		Bar 132	60.41	37.09	0.18	0.02			1.12	1.03	Chill cast.
17	135	L	1935	293, 473		Bar 59	59.35	38.36		1.06	0.12		0.13	0.98	Annealed at 650 C.
18	135	L	1935	293, 473		Bar 61	56.13	42.34		0.49		1.02			
19	133	L	1930	405-515	<2.0	Bar 55	81.19	18.63		0.02				0.2	Annealed at 700 C.
20	133	L	1930	321-508	<2.0	Bar 56	71.09	27.77		0.02				1.02	Annealed at 700 C.
21	133	L	1930	321-517	<2.0	Bar 57	59.85	39.36		0.02			0.07	0.7	Annealed at 700 C.
22	133	L	1930	307-490	<2.0	Bar 52	89.15	9.51		0.02			1.32		Annealed at 700 C.
23	133	L	1930	320-500	<2.0	Bar 54	59.98	37.88		0.03			2.01	0.1	Annealed at 700 C.
24	30	L	1925	363-702	<2.0	7:3 Brass	70.29	28.71		0.31			0.34	0.35	Cast.
25	30	L	1925	355-698	<2.0	Brass, high tensile	57.14	37.48	0.95	1.84	2.33			0.26	Cast.
26	215	L	1939	373, 673	<2.0	Cast Brass	58.91	37.68	0.48	1.24	0.76		0.1	0.78	Cast.
27	215	L	1939	373, 673	<2.0	Rolled Brass	58.82	37.78	0.49	1.09	0.66		0.28	0.85	Rolled.
28	81	L	1939	4.8-23		Silber Bronze	46.0	41.0				13.0			
29	81	L	1939	3.1-21.8		German silver	64.0	20.0				16.0			
30	17	P L	1958	293-353	1.0	Brass MS58	58.1	39.2		0.1			2.2	0.3	
31	17	P L	1958	293-353	1.0	Brass MS76/22/2	77.27	Bal	1.96		Trace	Trace			

SPECIFICATION TABLE NO. 270 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cu	Zn	Al	Fe	Mn	Ni	Pb	Sn	Composition (continued), Specifications and Remarks
32	37	C	1951	366-589	4.0	Brass	61.5	35.5					3.0		
33	77	E	1900	291,373		German red brass	85.7	7.15				0.58		6.39	
34	6	L	1931	432-688		Platinoid	62.0	22.0				15.0			Density at 22 C 8.66 g cm^{-3}.
35	88	L	1908	110-298		Platinoid	62.0	22.0				15.0			Density at 22 C 8.66 g cm^{-3}.
36	193	L	1939	18-290		Argentan	47.0	40.45				12.55			
37	9	L	1951	2.1-94		German Silver	47.0	41.0				9.0	2 0		As received.
38	229	L	1955	2.0-90		B.S. 249 Brass	55.0/ 60.0	Bal					2.0/ 3.5		0.75 impurities; as received.
39	229	L	1955	2.0-90		B.S. 249 Brass	55.0/ 60.0	Bal					2.0/ 3.5		0.75 impurities; heated to a dull red; heated for ten min and cooled slowly.
40	175	P	1936	373-973			71.00	28.43		0.24		Trace	0.25		Trace Si; annealed at 650 C for 1.5 hrs.
41	2	L	1948	2-4		Nickel Silver	45.9	42.1		0.15	0.05	9.8	2.0		Machined nearly to size, then annealed in air, followed by final light cut.
42	531	L	1936	293,473		Nickel Silver 1	62.62	27.14		0.04	0.13	10.05	0.005	Trace	0.007 C, 0.003 S; 0.009 Si;cast and machined.
43	531	L	1936	293,473		Nickel Silver 2	63.17	24.31		0.04	0.13	12.33	0.005	Trace	0.007 C, 0.003 S; 0.009 Si; cast and machined.
44	531	L	1936	293,473		Nickel Silver 3	62.43	22.08		0.04	0.10	15.35	0.003	Trace	0.014 C, 0.004 S; 0.003 Si;cast and machined.
45	531	L	1936	293,473		Nickel Silver 4	62.05	19.36		0.07	0.12	18.4	0.004	Trace	0.008 C, 0.003 S; 0.004 Si;cast and machined.
46	432	L	1957	4-124		Free-cutting leaded brass	$\approx$60.01	35.7	<0.001	0.01		0.01	3.27	1.0	0.01 Bi, 0.01 Cd, 0.01 Ag, 0.001 Sb, 0.001 In, <0.001 As, <0.001 Co, and <0.0001 Mg, 0.001 Si; hard tempered and ground.
47	518	L	1960	1.4-4.0		Z10	89.02	8.85		0.01		0.10	2.02		Annealed for 17 hrs at 500 C at ordinary atmosphere.
48	618	C	1960	313-328	± 3.0	Yellow brass	72	22					4	2	Specimen 20 mm in dia and 18 mm long; steel used as comparative material.
49	618	C	1960	305-325	± 3.0	Yellow brass	72	22					4	2	Specimen 20 mm in dia and 18 mm long; pure Ni used as comparative material.

SPECIFICATION TABLE NO. 270 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Zn	Al	Fe	Mn	Ni	Pb	Sn	Composition (continued), Specifications and Remarks
50	618	C	1960	301-320	± 3.0	Yellow brass	72	22					4	2	Specimen 20 mm in dia and 18 mm long; yellow brass used as comparative material.
51	618	C	1960	306-318	± 3.0	Yellow brass	72	22					4	2	Specimen 20 mm in dia and 18 mm long; Al used as comparative material.
52	511		1918	296.3		Red brass	~80/82	~12/7					5/~7	3/~4	Specimen 1.400 cm in dia; manufactured by Erba Co.
53	765	C	1957	298.2		Brass									Thermal comparator loaded with 100 gram weight applied on the plane lapped surface of the specimen.
54	851	L	1960	80~275	10	Brass	62.0	35.0					3.0		Free cutting yellow brass; 0.1877 in. dia and 2.224 in. long; turned down from a 0.375 in. dia rod obtained from commercial stock of J. M. Tull Metal and Supply Co.; data corrected for rise in temperature during measurement.
55	970	L	1959	85-118	<0.5	Brass	62.0	35.0					3.0		Specimen 0.25 in. in dia and 7.875 in. long; prepared from half-hard tempered drawn brass.

DATA TABLE NO. 270 THERMAL CONDUCTIVITY OF [COPPER + ZINC + ΣX_i] ALLOYS

($Cu + Zn < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
293.00	0.787
348.00	0.849
373.00	0.879
423.00	0.937
473.00	0.996
523.00	1.054
CURVE 2	
293.00	0.557
473.00	0.762
CURVE 3	
293.00	1.603
473.00	1.858
CURVE 4	
293.00	0.285
473.00	0.402
CURVE 5	
293.00	0.305
473.00	0.427
CURVE 6	
293.00	0.502
473.00	0.678
CURVE 7	
293.00	0.339
473.00	0.448
CURVE 8	
293.00	1.004
473.00	1.247
CURVE 9	
293.00	0.460
473.00	0.611
CURVE 10	
293.00	0.297
473.00	0.410
CURVE 11	
293.00	1.105
473.00	1.318
CURVE 12	
293.00	0.423
473.00	0.565
CURVE 13	
293.00	0.586
473.00	0.774
CURVE 14	
293.00	1.080
473.00	1.326
CURVE 15	
293.00	0.962
473.00	1.159
CURVE 16*	
293.00	1.004
473.00	1.197
CURVE 17*	
293.00	1.008
473.00	1.234
CURVE 18*	
293.00	1.138
473.00	1.297
CURVE 19	
405.00	1.603
CURVE 19 (cont.)	
457.40	1.686
515.40	1.774
CURVE 20	
321.00	1.136
338.60	1.167
357.20	1.192
398.80	1.255
398.60	1.264
450.10	1.326
450.10	1.335
507.40	1.406
507.70	1.414
CURVE 21	
320.50	1.197
320.50	1.184
337.90	1.218
338.00	1.201
355.90	1.238
356.00	1.222
395.40	1.259
395.90	1.255
401.40	1.259
447.60	1.318
448.50	1.314
456.60	1.318
504.70	1.381
506.10	1.377
517.20	1.361
CURVE 22	
316.80	1.812
320.50	1.866
329.70	1.862
333.00	1.895
343.30	1.912
346.00	1.925
389.80	1.975
389.90	2.000
438.00	2.067
438.10	2.084
490.40	2.172
490.50	2.146
CURVE 23*	
320.20	1.121
321.40	1.121
338.00	1.142
338.50	1.151
355.80	1.163
356.50	1.180
392.40	1.230
393.70	1.243
442.80	1.297
444.20	1.310
499.00	1.372
500.50	1.385
CURVE 24	
363.20	1.013
399.20	1.046
408.20	1.054
431.70	1.059
446.20	1.084
463.70	1.096
474.20	1.096
501.20	1.105
510.70	1.113
517.20	1.134
540.70	1.117
541.70	1.138
587.70	1.146
634.20	1.159
659.70	1.159
702.20	1.172
CURVE 25	
354.70	0.716
390.70	0.732
397.20	0.732
423.70	0.736
445.20	0.749
454.70	0.757
469.70	0.753
496.20	0.778
503.70	0.770
518.70	0.795
539.20	0.812
552.70	0.812
CURVE 25 (cont.)	
584.70	0.837
632.20	0.858
665.20	0.870
697.70	0.895
CURVE 26	
373.00	0.774
673.00	0.971
CURVE 27	
373.00	0.787
673.00	1.000
CURVE 28	
4.85	0.0102
6.65	0.0142
9.44	0.0231
9.84	0.0253
11.50	0.0307
14.20	0.0471
16.40	0.0480
23.10	0.0627
CURVE 29	
3.15	0.00889
5.62	0.0120
8.36	0.0449
10.88	0.0653
13.90	0.100
17.080	0.113
20.80	0.155
21.80	0.176
CURVE 30*	
293.20	1.084
323.20	1.132
353.20	1.180
CURVE 31*	
293.20	0.922
CURVE 31 (cont.)	
323.20	0.977
353.20	1.036
CURVE 32*	
366.50	1.157
422.00	1.215
477.50	1.272
533.20	1.332
588.70	1.389
CURVE 33*	
291.20	0.597
373.20	0.710
CURVE 34	
432.20	0.364
489.20	0.383
500.20	0.435
513.20	0.456
578.20	0.452
591.20	0.448
633.20	0.473
688.20	0.490
CURVE 35	
110.20	0.179
113.20	0.180
123.20	0.184
148.20	0.188
173.20	0.197
198.20	0.205
223.20	0.213
248.20	0.226
273.20	0.234
291.20	0.247
298.20	0.250
CURVE 36	
18.00	0.0490
78.00	0.170
290.00	0.895
CURVE 37	
2.10	0.00267*
2.33	0.00314*
2.66	0.00377*
3.23	0.00480*
3.69	0.00582*
4.04	0.00677
4.55	0.00843
5.53	0.0107
9.50	0.0254
14.10	0.0455
20.70	0.0751
30.70	0.107
57.30	0.152
94.50	0.167
CURVE 38	
2.00	0.013
3.00	0.021
4.00	0.029
5.00	0.037
6.00	0.046
8.00	0.064
10.00	0.082
15.00	0.130
20.00	0.175
25.00	0.215
30.00	0.255
40.00	0.330
50.00	0.400
60.00	0.460
70.00	0.500
80.00	0.530
90.00	0.540
CURVE 39	
2.00	0.015
3.00	0.023
4.00	0.034
5.00	0.044
6.00	0.054
8.00	0.075
10.00	0.096
15.00	0.146
20.00	0.193
90.00	0.540
CURVE 40	
373.20	1.414
473.20	1.155
479.20	1.143
538.20	1.030
573.20	1.188
577.20	1.231
635.20	1.671
673.20	1.033
677.20	1.028
751.20	1.123
773.20	1.109
842.20	1.049
873.20	1.033
888.20	1.030
973.20	1.013
CURVE 41	
1.40	0.00100
1.75	0.00351
1.95	0.00460
2.20	0.00540
2.45	0.00760
3.40	0.00211
4.00	0.00345
CURVE 42*	
293.2	0.372
473.2	0.452
CURVE 43*	
293.2	0.301
473.2	0.377
CURVE 44*	
293.2	0.268
473.2	0.339
CURVE 45*	
293.2	0.226
473.2	0.272

*Not shown on plot

DATA TABLE NO. 270 (continued)

T	k
CURVE 46	
4.0	0.022
6.0	0.032
8.0	0.045
10.0	0.056
20.0	0.119
30.0	0.185
40.0	0.235
60.0	0.335
80.0	0.400
100.0	0.460
124.0	0.520
CURVE 47	
1.37	0.0164
1.76	0.0211
2.0	0.0245
2.31	0.0294
2.79	0.0363
3.0	0.0400
3.38	0.0455
3.75	0.0529
3.88	0.0557
4.0	0.0592
CURVE 48*	
312.7	1.097
320.2	1.109
327.7	1.119
CURVE 49*	
305.0	1.069
310.7	1.086
317.9	1.102
325.1	1.118
CURVE 50*	
301.2	1.074
303.7	1.099
306.9	1.110
309.7	1.148
310.2	1.132
313.4	1.122
CURVE 50 (cont.)*	
313.5	1.119
316.4	1.133
319.7	1.129
320.0	1.140
CURVE 51*	
305.7	1.110
308.7	1.116
311.7	1.110
314.7	1.127
317.7	1.135
CURVE 52*	
296.3	1.085
CURVE 53*	
298.2	1.14
CURVE 54*	
79.88	0.434
92.40	0.470
113.36	0.542
133.44	0.610
158.78	0.708
177.60	0.774
198.01	0.855
217.34	0.940
240.84	1.05
256.64	1.11
275.36	1.18
CURVE 55*	
84.67	0.406
88.73	0.498
98.90	0.523
109.01	0.564
118.24	0.605

*Not shown on plot

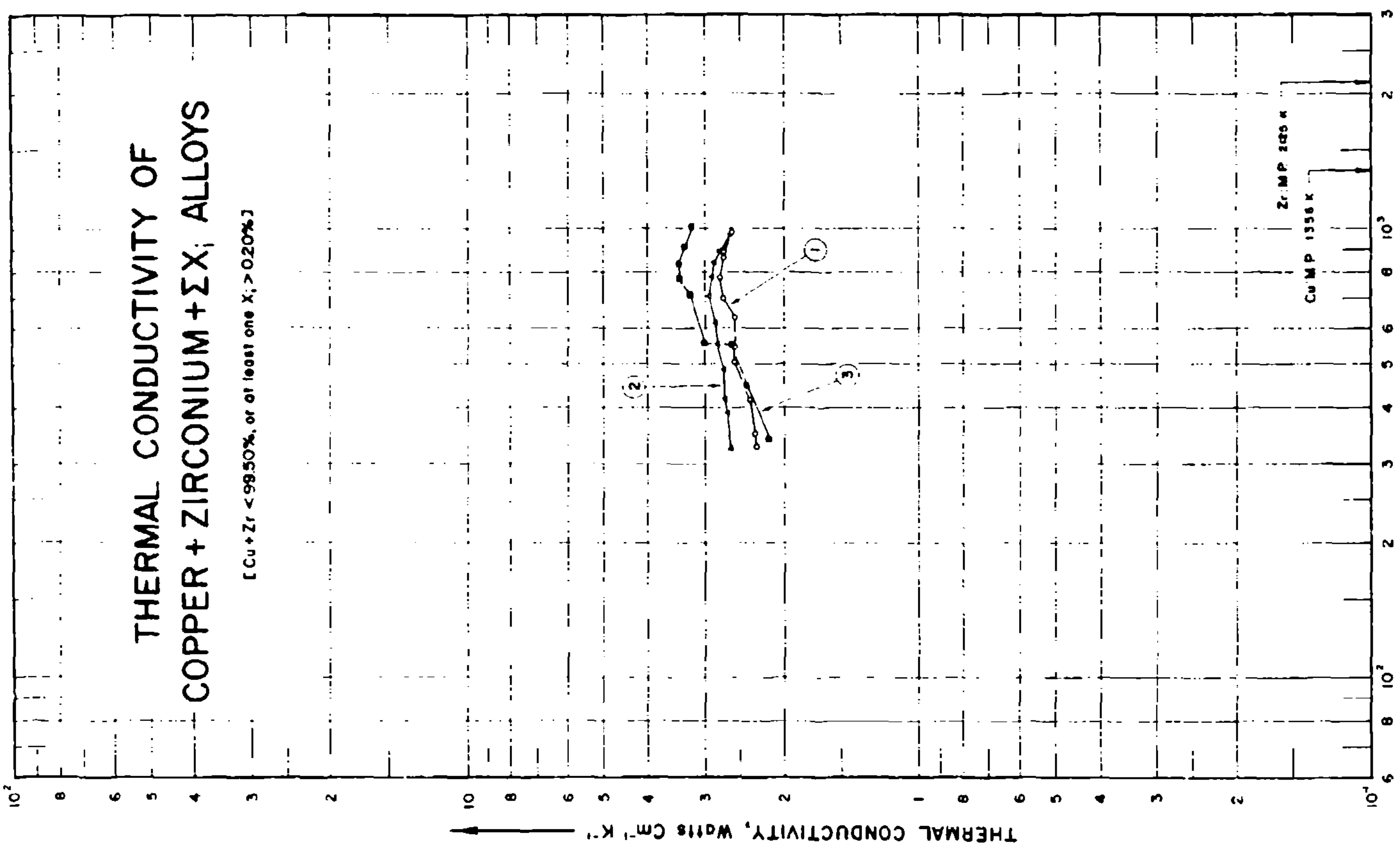

THERMAL CONDUCTIVITY OF
COPPER + ZIRCONIUM + ΣX; ALLOYS
[Cu + Zr < 99.50%, or at least one X; > 0.20%]
Zr: M.P. 2125 K
Cu: M.P. 1356 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 271

SPECIFICATION TABLE NO. 271 THERMAL CONDUCTIVITY OF [COPPER + ZIRCONIUM + ΣX_i] ALLOYS

(Cu + Zr < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 271]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	Zr	Co	Al	Cr	Composition (continued), Specifications and Remarks
1	377		1957	328-982			99.26	0.29	0.25	0.2		Electrical conductivity 28.34, 26.94, 23.25, 20.75, 19.10, 16.5, 15.85, 14.45, 12.93, 12.55 and 10.83 x 10^4 ohm^{-1} cm^{-1} at 54.6, 77.1, 142.8, 234.1, 273.6, 366.6, 427.1, 507.1, 587.6, 618.6 and 708.6 C, respectively.
2	377		1957	321-975			99.4	0.3	0.3			Electrical conductivity 33.55, 28.12, 26.35, 23.18, 20.95, 18.9, 17.1, 15.33, 14.10, 12.68 and 10.95 x 10^4 ohm^{-1} cm^{-1} at 47.25, 115.9, 145.8, 214.8, 281.8, 346.4, 436.6, 508.6, 567, 618.3 and 701.6 C, respectively.
3	378		1957	340-1014			72.8	27.0			0.2	Electrical resistivity 4.0, 4.77, 5.32, 5.5, 5.56, 5.79, 6.26, 6.9 and 7.95 μohm cm at 67, 176.4, 277.2, 283.8, 439.5, 506, 565, 637.1 and 740.6 C, respectively.

DATA TABLE NO. 271 THERMAL CONDUCTIVITY OF [COPPER + ZIRCONIUM + ΣX_i] ALLOYS

(Cu + Zr < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
327.8	2.31
350.3	2.33
416.0	2.38
507.3	2.58
546.8	2.57
639.8	2.58
700.3	2.74
780.3	2.79
860.8	2.73
891.8	2.74
981.8	2.60
CURVE 2	
320.5	2.62
389.1	2.68
419.0	2.71
488.0	2.74
555.0	2.82
619.6	2.85
709.8	2.95
781.8	2.90
840.2	2.87
891.5	2.79
974.8	2.62
CURVE 3	
340.2	2.16
449.6	2.44
550.4	2.62
557.0	3.03
712.7	3.25
779.2	3.41
838.2	3.42
910.3	3.34
1013.9	3.23

THERMAL CONDUCTIVITY OF LANTHANUM + NEODYMIUM + ΣX; ALLOYS

[La + Nd < 99.50%, or at least one X, > 0.20%]

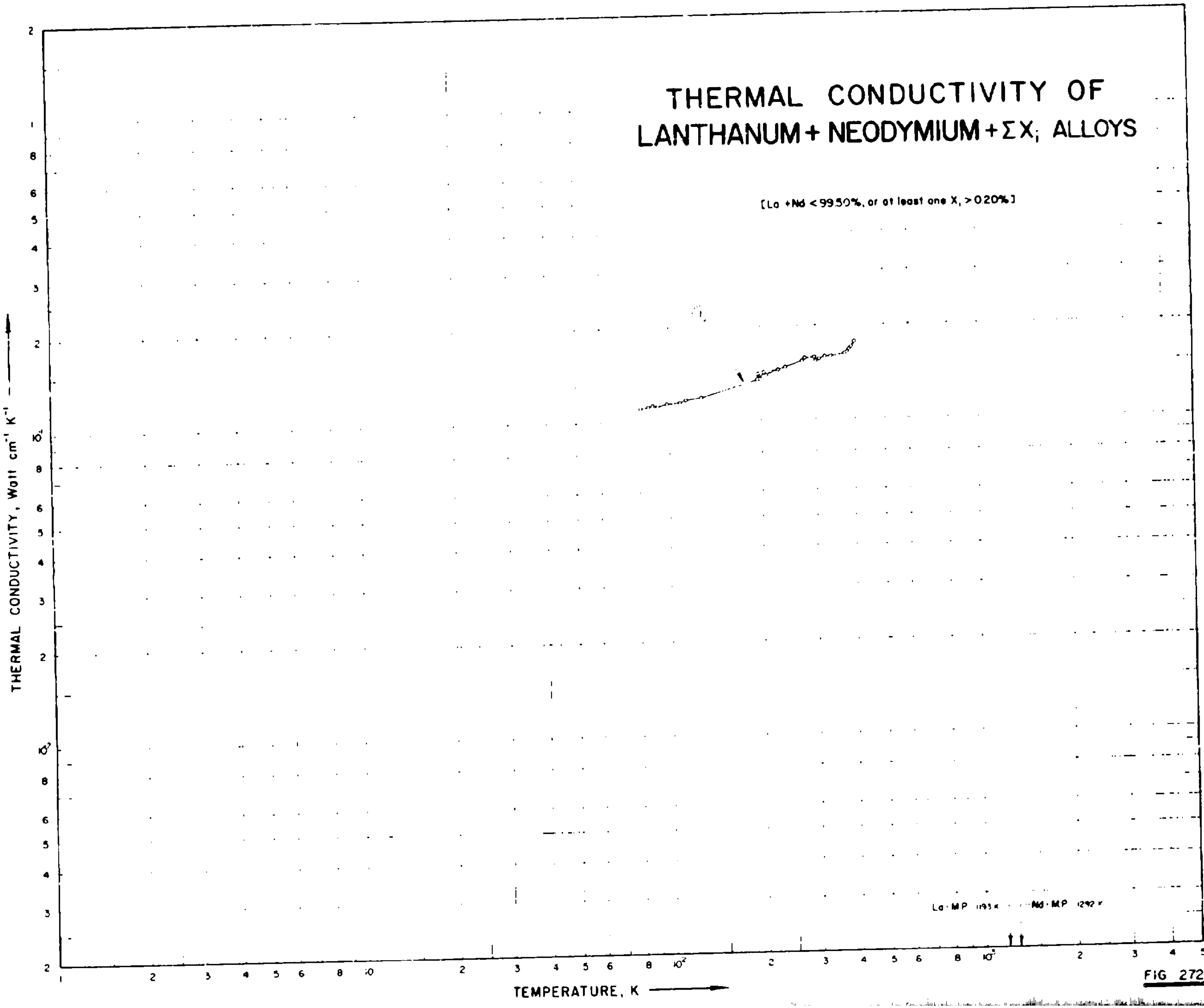


FIG 272

SPECIFICATION TABLE NO. 272 THERMAL CONDUCTIVITY OF [LANTHANUM + NEODYMIUM + ΣX_i]

($La + Nd < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 272]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) La	Nd	Ca	Ce	Cu	Fe	Ta	Composition (continued), Specifications and Remarks
1	932,933	L	1966	81-401	±3 to ±5			0.5	0.25	0.1	0.005	0.04	0.15	Polycrystalline with a hexagonal structure; obtained from lot 499; electrical resistivity reported as 39.2, 50.5, 59.2, 68.0, 74.0, 79.7, 84.6, and 88.8 μohm cm at 99, 152, 203, 253, 301, 348, 399, and 448 K, respectively; measured in a vacuum of 10^{-4} ~10^{-5} mm Hg.

DATA TABLE NO. 272 THERMAL CONDUCTIVITY OF [LANTHANUM + NEODYMIUM + ΣX_i] ALLOYS

(La + Nd < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
81	0.111
86	0.112
89	0.114
92	0.113
99	0.115
109	0.116
114	0.118
128	0.120
195	0.136
196	0.141
199	0.136
201	0.139*
205	0.142
208	0.139
216	0.144
227	0.145
241	0.147
273	0.154
277	0.157
279	0.153*
299	0.158
301	0.154
305	0.157*
309	0.156
314	0.155*
322	0.159
339	0.159
374	0.162
376	0.166*
380	0.164
386	0.167
393	0.171
401	0.177

*Not shown on plot

SPECIFICATION TABLE NO. 273 THERMAL CONDUCTIVITY OF [LEAD + ANTIMONY + ΣX_i] ALLOYS $Pb + Sb + \Sigma X_i$

($Pb + Sb < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent)	Composition (continued), Specifications and Remarks
1	224	L	1923	348		SAE Bearing Ay. No. 12		63.94 Pb, 28.84 Sb, and 7.07 Cu.

DATA TABLE NO. 273 THERMAL CONDUCTIVITY OF [LEAD + ANTIMONY + ΣX_i] ALLOYS $Pb + Sb + \Sigma X_i$

($Pb + Sb < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
348.0	0.318

*No graphical presentation

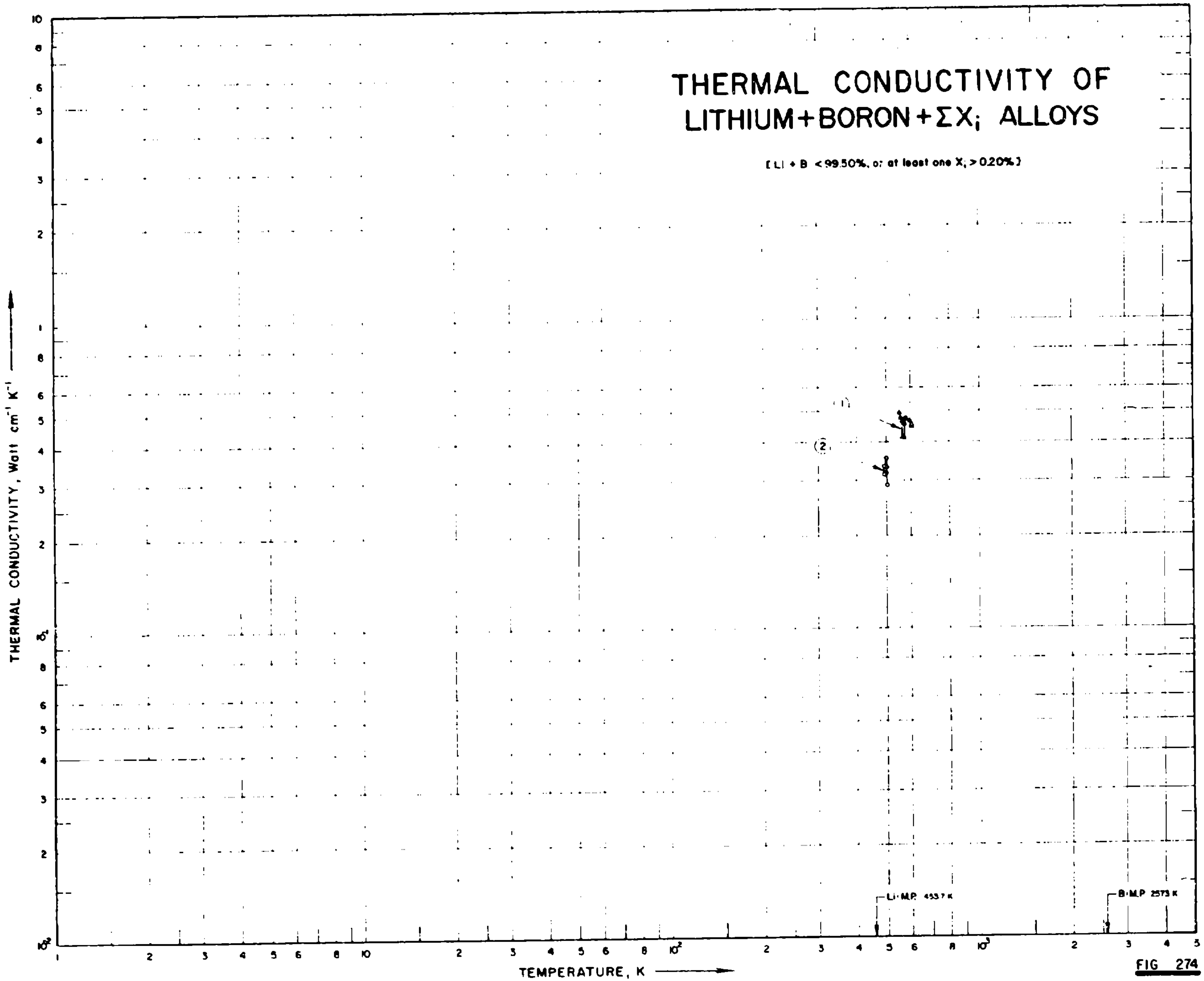

THERMAL CONDUCTIVITY OF
LITHIUM+BORON+ΣX_i ALLOYS
[Li + B < 99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
Li-M.P. 453.7 K
B-M.P. 2573 K
(1)
(2)

FIG 274

SPECIFICATION TABLE NO. 274 THERMAL CONDUCTIVITY OF [LITHIUM + BORON + ΣX_i] ALLOYS

(Li + B < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 274]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Li	B	Composition (continued), Specifications and Remarks
1	243	L	1950	553-606	±10		99.22	0.2	0.1 Ca, <0.1 Hg, <0.1 P, 0.1 Al, 0.02 Cr, 0.04 Cu <0.01 K, <0.1 Na, <0.01 Ni; measured in liquid state, apparatus in open air at room temperature.
2	243	L	1950	491-505	±10		99.22	0.2	0.1 Ca, <0.1 Hg, <0.1 P, 0.1 Al, 0.02 Cr, 0.04 Cu, <0.01 K, <0.1 Na, <0.01 Ni; measured in liquid state, apparatus in heated oven.

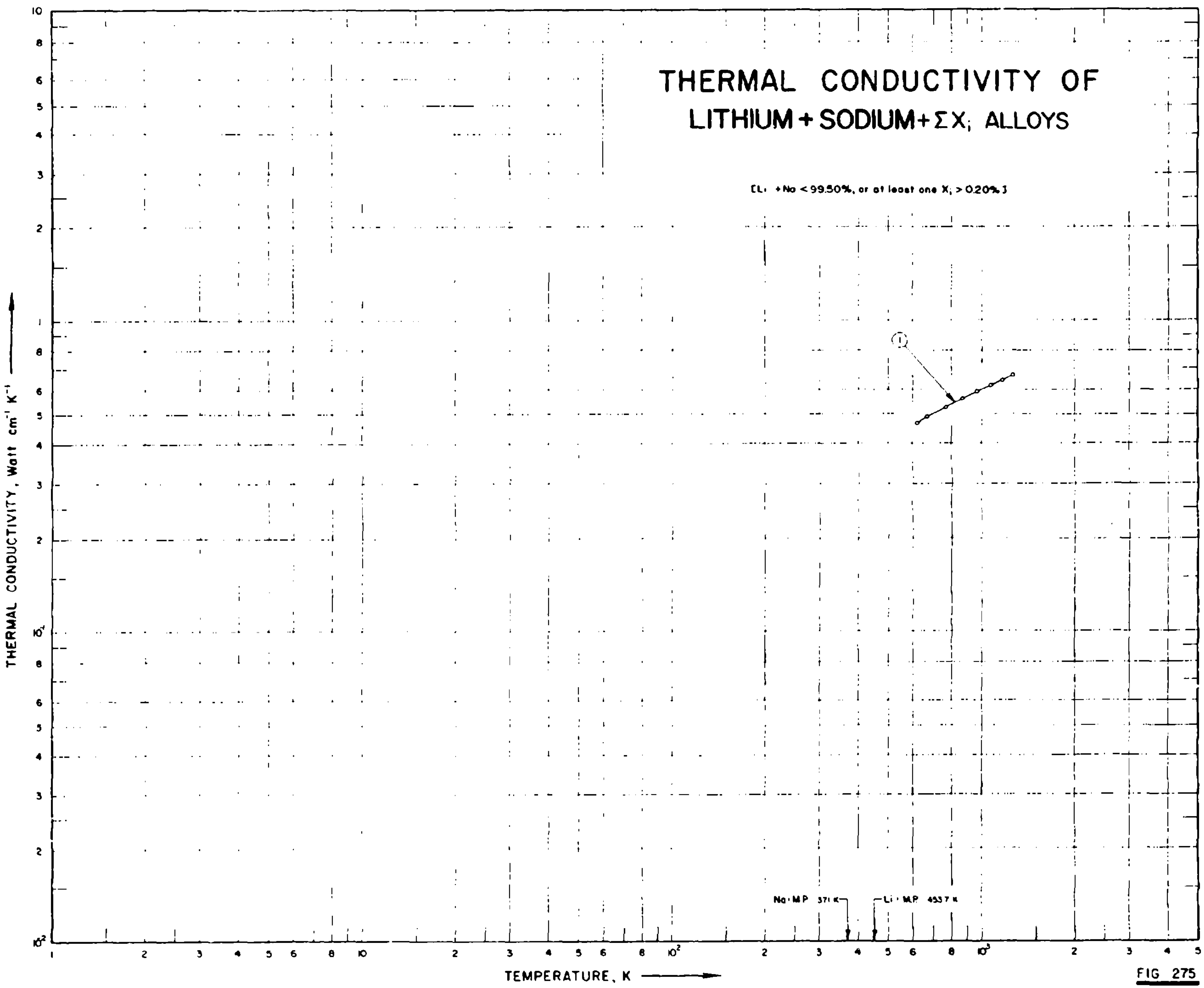
DATA TABLE NO. 274 THERMAL CONDUCTIVITY OF [LITHIUM + BORON + ΣX_i] ALLOYS

(Li + B < 99.50% or at least one X_i >0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
553.2	0.494
558.2	0.477
566.2	0.464
568.2	0.414
568.2	0.414*
568.2	0.414*
572.2	0.414
572.2	0.473
573.2	0.456
584.2	0.477
598.2	0.464
605.2	0.452
606.2	0.448
CURVE 2	
491.2	0.335
493.2	0.314
493.2	0.318*
501.2	0.356
501.2	0.331
501.2	0.318
501.2	0.322*
501.2	0.318*
505.2	0.289

*Not shown on plot



THERMAL CONDUCTIVITY OF
LITHIUM + SODIUM + ΣX; ALLOYS
[Li + Na < 99.50%, or at least one X; > 0.20%]
Na: MP 371 K
Li: MP 453.7 K
1
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 275

SPECIFICATION TABLE NO. 275 THERMAL CONDUCTIVITY OF [LITHIUM + SODIUM + ΣX_i] ALLOYS

(Li + Na < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 275]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Li	Na	Composition (continued), Specifications and Remarks
1	769, 866	P	1962	623-1273			~98.96	0.27	0.19 Fe, 0.18 Mg, 0.08 C, 0.06 Cu, 0.052 Ni, 0.05 Cr, 0.032 Pb, 0.023 Sn, 0.016 Ti, 0.01 Ce, <0.01 Sb, <0.01 Zn, 0.006 Ba, 0.058 Mo, 0.0046 Ca, 0.0044 N, 0.0042 V, 0.0037 Al, 0.003 K, 0.0029 Mn, 0.002 Bi, <0.001 Be, 0.001 Cd, 0.001 In and <0.003 Ag; filtered through a capillary with an I. D. of 15 mm, poured in a vacuum of ~1 x 10^{-2}mm Hg into a thin-walled steel (1 Kh 18N 9T) tube 8.6 mm in dia, 230 mm long and 0.2 mm wall thickness; measured in vacuum.

DATA TABLE NO. 275 THERMAL CONDUCTIVITY OF [LITHIUM + SODIUM + ΣX_i] ALLOYS

(Li + Na < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
623.2	0.469
673.2	0.490
773.2	0.527
873.2	0.561
973.2	0.594
1073.2	0.62[illegible]
1173.2	0.644
1273.2	0.669

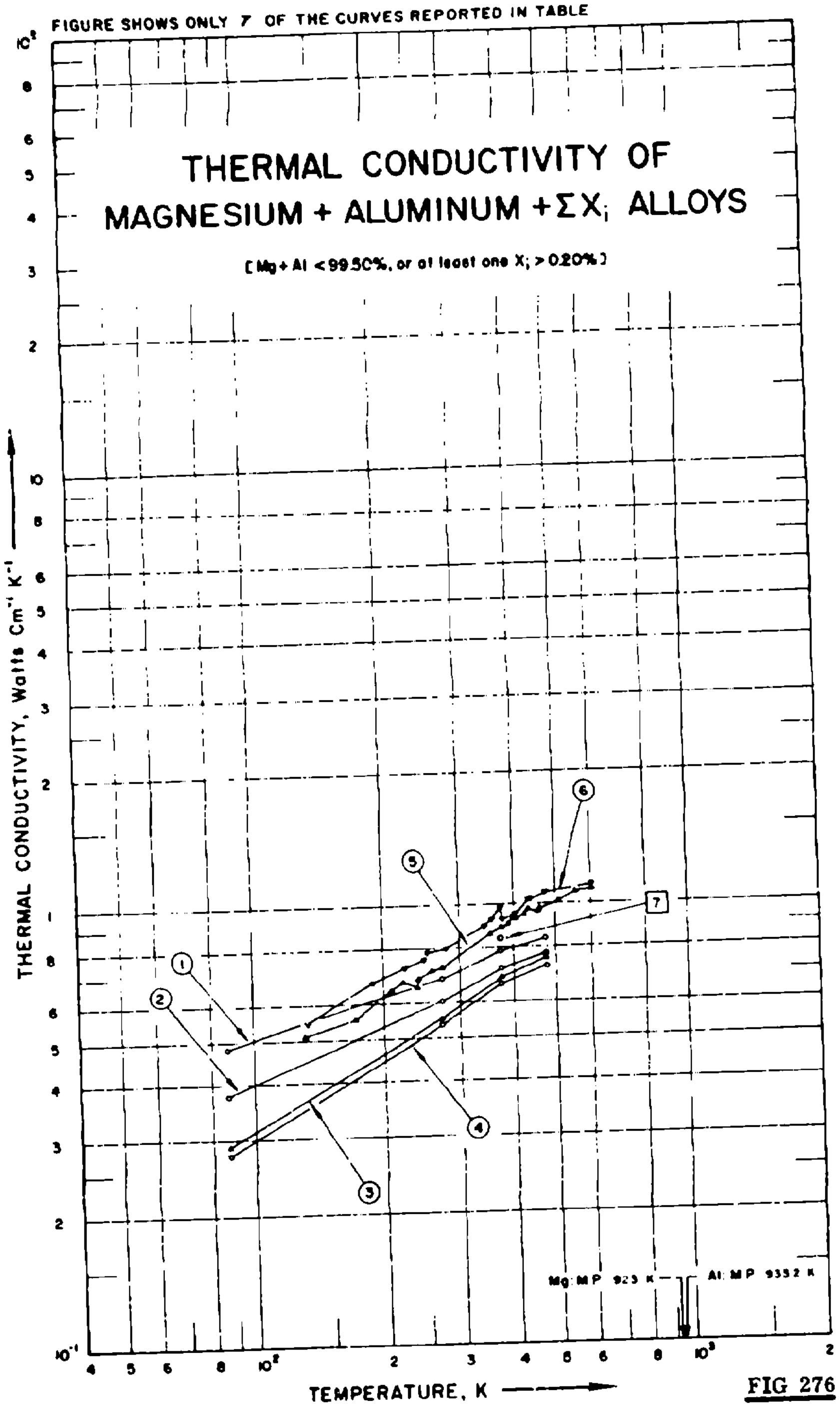


FIGURE SHOWS ONLY 7 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
MAGNESIUM + ALUMINUM + ΣX_i ALLOYS
[Mg + Al < 99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Mg: MP 923 K
Al: MP 933.2 K
1
2
3
4
5
6
7

FIG 276

SPECIFICATION TABLE NO. 276 THERMAL CONDUCTIVITY OF [MAGNESIUM + ALUMINUM + ΣX_i] ALLOYS

($Mg + Al < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 276]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Al	Cu	Fe	Mn	Ni	Si	Zn	Composition (continued), Specifications and Remarks
1	93, 850	L	1931, 1929	87-476	3-4		92.0	6.0					2.0		As cast; electrical conductivity 9.98, 7.24, 6.31 and 5.75 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
2	93, 850	L	1931, 1929	87-476	3-4		90.0	8.0					2.0		As cast; electrical conductivity 9.15, 6.42, 5.53 and 5.19 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
3	93, 850	L	1931, 1929	87-476	3-4		88.0	10.0					2.0		As cast; electrical conductivity 8.83, 6.28, 5.16 and 4.70 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
4	93, 850	L	1931, 1929	87-476	3-4		86.0	12.0					2.0		As cast; electrical conductivity 8.71, 6.20, 5.10 and 4.62 x 10^4 ohm^{-1} cm^{-1} at 87, 273, 373 and 476 K, respectively.
5	91	C	1951	130-605		AN-M-29	Bal	2.5/ 3.5	0.05	0.005	0.2	0.005	0.3	0.7/ 1.3	0.3 total other impurities; specimen 2 cm in dia and 15 cm long; hot-rolled parallel to the heat flow direction; annealed for 1 hr at 600 C; Armco iron used as comparative material.
6	91	C	1951	134-607		AN-M-29	Bal	2.5/ 3.5	0.05	0.005	0.2	0.005	0.3	0.7/ 1.3	0.3 total other impurities; specimen 2 cm in dia and 15 cm long; hot-rolled perpendicular to the heat flow direction; annealed for 1 hr at 600 C, Armco iron used as comparative material.
7	53	E	1927	373	1.0		94.0	4.0	2.0						Forged.
8	673	E	1932	295.2	±1.3	Elekton 2	93.0	4.0						1.0	1.0 Cd, 1.0 Sn.
9	673	E	1932	301.6	±1.3	Dow metal 3	90.6	6.0		0.4				3.0	
10	673	E	1932	295.3	±1.3	Dow metal 4	92.5	4.0						0.5	2.0 Cd, 1.0 Sn.
11	673	E	1932	305.3	±1.3	Dow metal 5	92.0	4.0							3.0 Cd, 1.0 Sn.
12	673	E	1932	303.3	±1.3	Dow metal 6	92.0	4.0							2.0 Cd, 2.0 Sn.

DATA TABLE NO. 276 THERMAL CONDUCTIVITY OF [MAGNESIUM + ALUMINUM + ΣX_i] ALLOYS

($Mg + Al < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
87.00	0.481
273.09	0.686
373.00	0.787
476.00	0.837
CURVE 2	
87.00	0.377
273.00	0.607
373.00	0.720
476.00	0.778
CURVE 3	
87.00	0.289
273.00	0.552
373.00	0.682
476.00	0.753
CURVE 4	
87.00	0.276
273.00	0.536
373.00	0.661
476.00	0.728
CURVE 5	
130.80	0.510
171.50	0.552
207.70	0.644
222.30	0.674
239.90	0.653
240.10	0.686
257.00	0.711
273.20	0.728
354.80	0.858
374.40	0.879
377.90	0.900
400.00	0.911
403.50	0.925
421.60	0.946
CURVE 5 (cont.)	
431.10	0.975
454.60	0.962
458.00	0.975
506.80	1.013
556.50	1.063
604.80	1.071
CURVE 6	
133.90	0.548
189.80	0.674
223.60	0.728
248.20	0.757
252.30	0.782
280.00	0.799
311.40	0.895
356.40	0.929
371.60	0.983
376.60	0.925
401.50	0.950
435.70	1.033
438.80	1.033
470.70	1.063
606.80	1.100
CURVE 7	
373.00	0.837
CURVE 8*	
295.2	0.556
CURVE 9	
301.6	0.611*
CURVE 10*	
295.3	0.632
CURVE 11*	
305.3	0.695
CURVE 12*	
303.3	0.556

*Not shown on plot

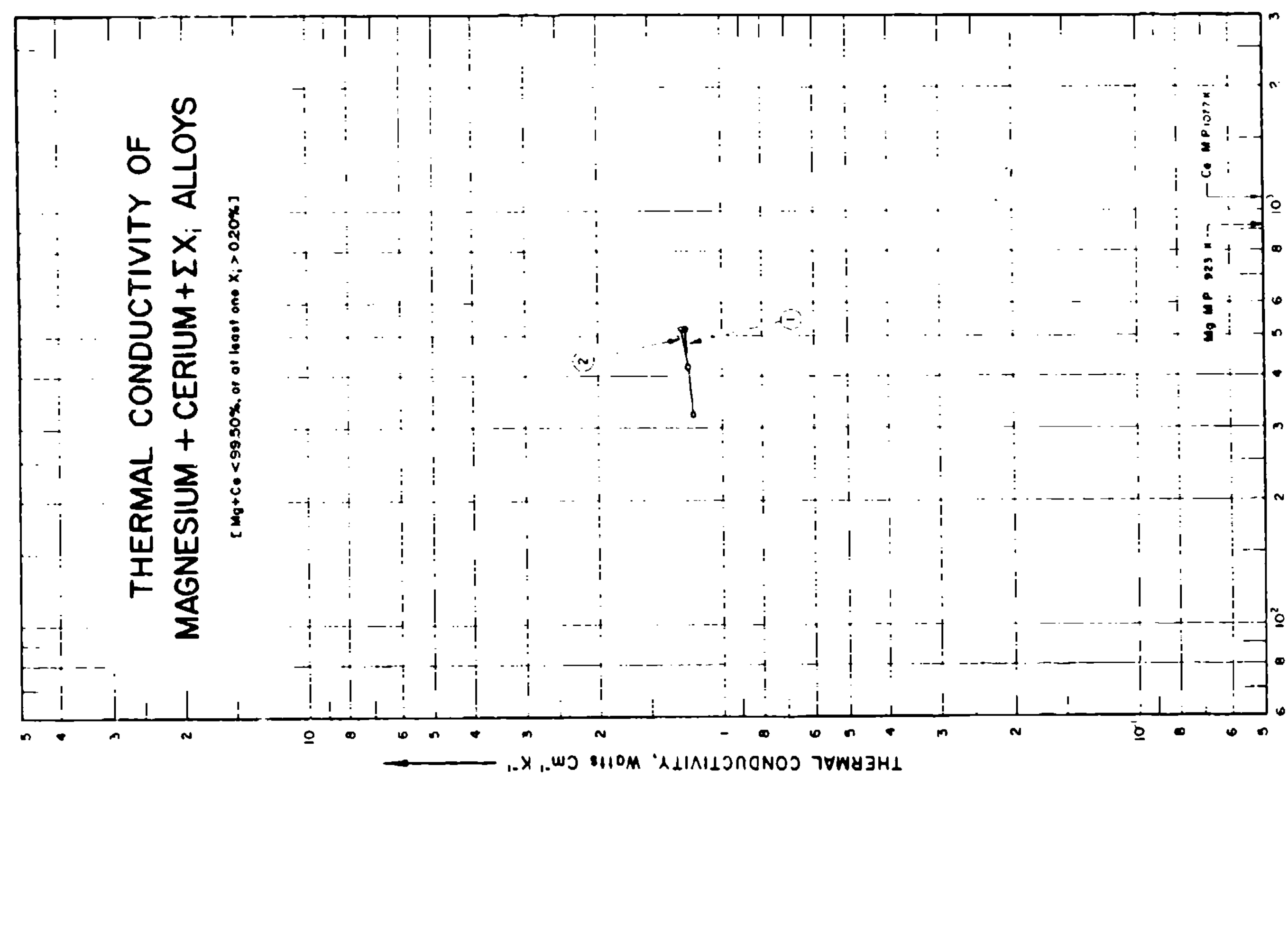

THERMAL CONDUCTIVITY OF
MAGNESIUM + CERIUM + ΣX_i ALLOYS
[Mg+Ce <99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Mg MP 923 K
Ce MP 1077 K
1
2

FIG 277

SPECIFICATION TABLE NO. 277 THERMAL CONDUCTIVITY OF [MAGNESIUM + CERIUM + ΣX_i] ALLOYS

(Mg + Ce $\geq$ 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 277]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Ce	Mn	Co	Composition (continued), Specifications and Remarks
1	397	L	1939	323-523	3	W. 1662	94.96	3.17	1.8		Mg containing 0.07 impurities; specimen ~30 cm long and 1.4 cm in dia; density 1.78 g cm^{-3}; forged at elevated temperature; electrical resistivity 6.25, 6.8, 8.5 and 10.25 μohm cm at 20, 50, 150 and 250 C, respectively.
2	397	L	1939	323-523	±3	N. P. L. P2	87.44	9.0	0.5	3.0	Similar to the above specimen except density 1.87 g cm^{-3} and electrical resistivity 6.1, 6.65, 8.5 and 10.4 μohm cm at 20, 50, 150 and 250 C, respectively.

DATA TABLE NO. 277 THERMAL CONDUCTIVITY OF [MAGNESIUM + CERIUM + ΣX_i] ALLOYS

($Mg + Ce < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
323.2	1.172
423.2	1.213
523.2	1.234
CURVE 2	
323.2	1.172
423.2	1.213
523.2	1.255

SPECIFICATION TABLE NO. 278 THERMAL CONDUCTIVITY OF [MAGNESIUM + COBALT + ΣX_i] ALLOYS $Mg + Co + \Sigma X_i$

($Mg + Co < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	397	L	1939	323-523	< 3.0	W-1702	93.73 Mg, 2.4 Co, 2.2 Ce, 1.6 M, and 0.07 impurities; forged at elevated temp.

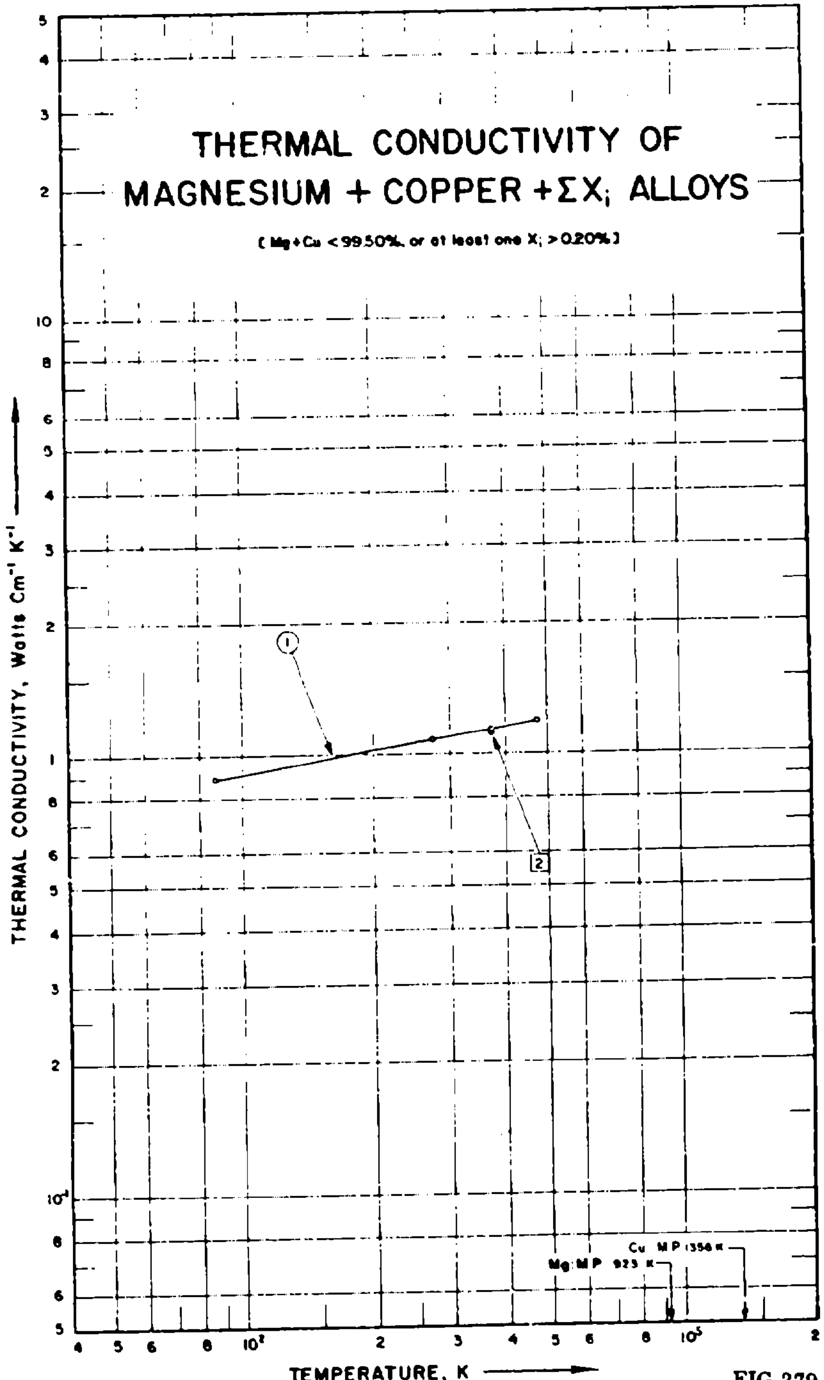
DATA TABLE NO. 278 THERMAL CONDUCTIVITY OF [MAGNESIUM + COBALT + ΣX_i] ALLOYS $Mg + Co + \Sigma X_i$

($Mg + Co < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
323.2	1.32
423.2	1.32
523.2	1.32

*No graphical presentation



THERMAL CONDUCTIVITY OF
MAGNESIUM + COPPER + ΣX_i ALLOYS
[Mg + Cu < 99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}
TEMPERATURE, K
Cu M.P. 1356 K
Mg M.P. 923 K

FIG 279

SPECIFICATION TABLE NO. 279 THERMAL CONDUCTIVITY OF [MAGNESIUM + COPPER + ΣX_i] ALLOYS

(Mg + Cu < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 279]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Cu	Al	Fe	Mn	Ni	Si	Composition (continued), Specifications and Remarks
1	93	L	1931	87–476	3.0–4.0		77	20					3	As cast.
2	53	E	1927	373	1.0		94	4	2					Forged.

DATA TABLE NO. 279 THERMAL CONDUCTIVITY OF [MAGNESIUM + COPPER + ΣX_i] ALLOYS

(Mg + Cu < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
87	0.891
273	1.079
373	1.146
476	1.192
CURVE 2	
373	1.130

SPECIFICATION TABLE NO. 280 THERMAL CONDUCTIVITY OF [MAGNESIUM + NICKEL + ΣX_i] ALLOYS $Mg + Ni + \Sigma X_i$

($Mg + Ni < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mg	Ni	Ce	Composition (continued), Specifications and Remarks
1	397	L	1939	323-523	<3.0	W-1648	91.93	5.36	2.65	0.06 impurities; forged at elevated temp; density 1.87 g cm^{-3}.

DATA TABLE NO. 280 THERMAL CONDUCTIVITY OF [MAGNESIUM + NICKEL + ΣX_i] ALLOYS $Mg + Ni + \Sigma X_i$

($Mg + Ni < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1*	
323.2	1.30
423.2	1.30
523.2	1.30

*No graphical presentation

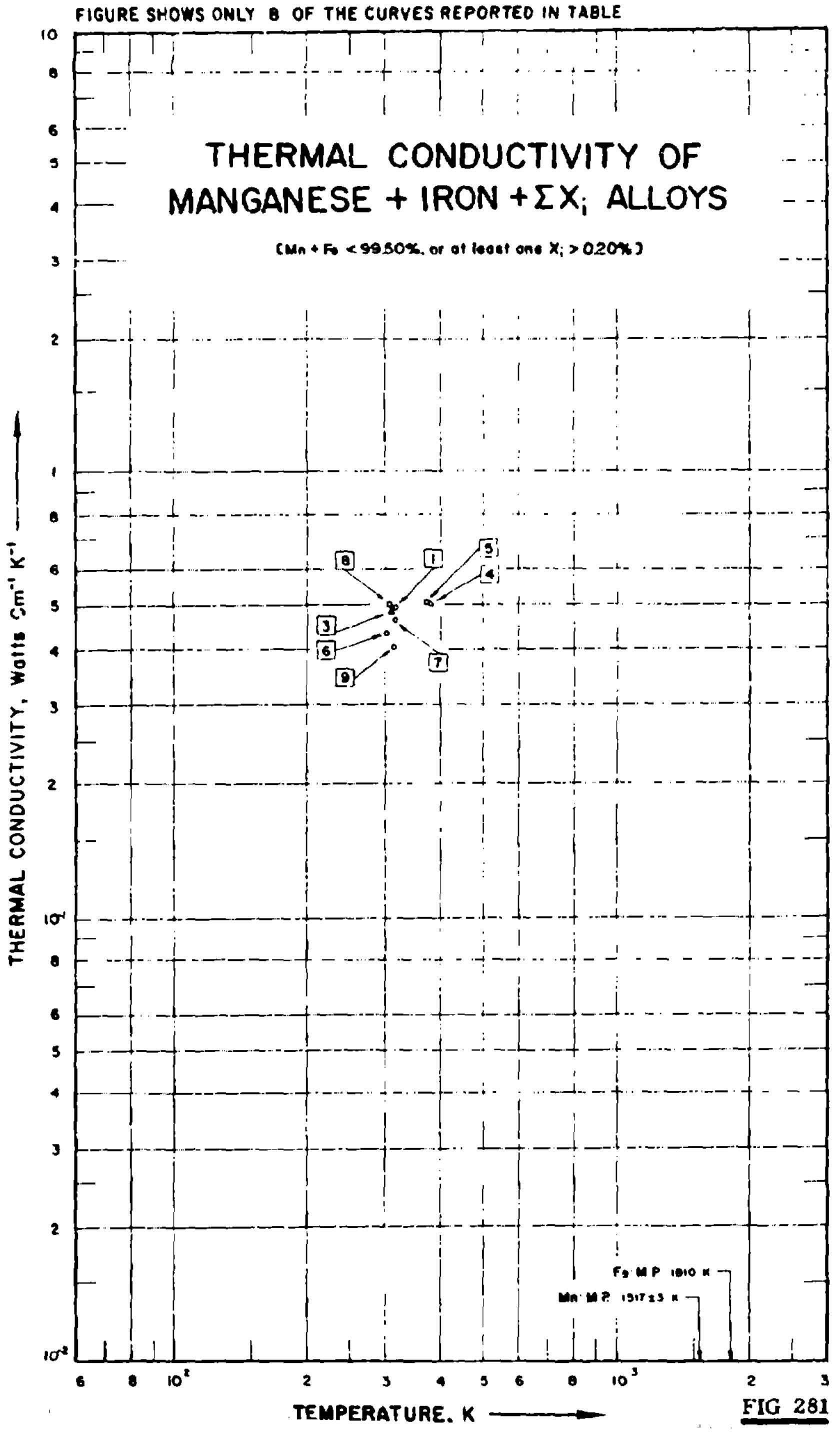


FIGURE SHOWS ONLY 8 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
MANGANESE + IRON + ΣX; ALLOYS
(Mn + Fe < 99.50%, or at least one X; > 0.20%)
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Fe M.P. 1810 K
Mn M.P. 1517±3 K
1
3
4
5
6
7
8
9

FIG 281

SPECIFICATIONS TABLE NO. 281 THERMAL CONDUCTIVITY OF [MANGANESE + IRON + ΣX_i] ALLOY

(Mn + Fe < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 281]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mn	Fe	C	Si	Composition (continued), Specifications and Remarks
1	204	L	1937	317.7		Ferromanganese, 12	70.54	25.28	1.12	3.06	
2	204	L	1937	316.4		Ferromanganese, 13	79.0	17.89	2.36	1.75	
3	204	L	1937	314.6		Ferromanganese, 14	78.18	17.46	1.38	2.98	
4	204	L	1937	382.9		Ferromanganese, 15	78.0	15.5	4.7	1.8	From blast furnace.
5	204	L	1937	375.1		Ferromanganese, 16	73.0	26.48		0.52	From blast furnace.
6	204	L	1937	303.3		Ferromanganese, 17	77.33	13.73	6.92	2.02	Heat flow perpendicular to the thickness.
7	204	L	1937	318.8		Ferromanganese, 18	73.02	18.67	6.62	1.69	
8	204	L	1937	308.0		Ferromanganese, 19	77.3	15.36	6.65	1.69	
9	204	L	1937	315.1		Silicomanganese, 21	64.02	18.09	0.55	17.34	Highly crystalline specimen.

DATA TABLE NO. 281 THERMAL CONDUCTIVITY OF [MANGANESE + IRON + ΣX_i] ALLOY

(Mn + Fe < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K ; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

CURVE 1	
317.7	0.493
CURVE 2 *	
316.4	0.494
CURVE 3	
314.6	0.486
CURVE 4	
382.9	0.500
CURVE 5	
375.1	0.504
CURVE 6	
303.3	0.434
CURVE 7	
318.8	0.464
CURVE 8	
308.0	0.500
CURVE 9	
315.1	0.404

* Not shown on plot

SPECIFICATION TABLE NO. 282 THERMAL CONDUCTIVITY OF [MANGANESE + SILICON + ΣX_i] ALLOYS Mn + Si + ΣX_i

(Mn + Si < 99.50% or at least one X_i > 0.20%)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	204	L	1937	310.2		Silicomanganese, 20	63.7 Mn, 17.8 Si, and 1.05 C.

DATA TABLE NO. 282 THERMAL CONDUCTIVITY OF [MANGANESE + SILICON + ΣX_i] ALLOYS Mn + Si + ΣX_i

(Mn + Si < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
310.2	0.468

*No graphical presentation

SPECIFICATION TABLE NO. 283 THERMAL CONDUCTIVITY OF [MOLYBDENUM + IRON + ΣX_i] ALLOYS $Mo + Fe + \Sigma X_i$

($Mo + Fe < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mo	Fe	Si	C	Composition (continued), Specifications and Remarks
1	204	L	1937	332.8		Ferromolybdenum, 34	81	14.59	2.41	2.0	2.41 Si.
2	204	L	1937	380.4		Ferromolybdenum, 35	67.77	31.88	0.26	0.09	0.26 Si.
3	118	R	1956	1080-2795	5			0.25	0.073	0.007	0.021 Ti, 0.013 Cu, and 0.0003 Cr; after test the contents of Si and C changed to 0.063 and 0.008, respectively; hollow cylindrical specimen of 2 in. O.D. and 0.375 in. I.D.; supplied by Climax Molybdenum Co.; arc-melted unalloyed; density 10.22 g cm^{-3}.

DATA TABLE NO. 283 THERMAL CONDUCTIVITY OF [MOLYBDENUM + IRON + ΣX_i] ALLOYS $Mo + Fe + \Sigma X_i$

($Mo + Fe < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
332.8	0.585
CURVE 2*	
380.4	0.596
CURVE 3*	
1080.3	1.007
1222.6	1.026
1358.6	0.929
1474.2	1.006
1612.1	0.954
2137.6	0.897
2318.7	0.879
2488.2	0.936
2651.5	0.835
2795.3	0.865

* No graphical presenation

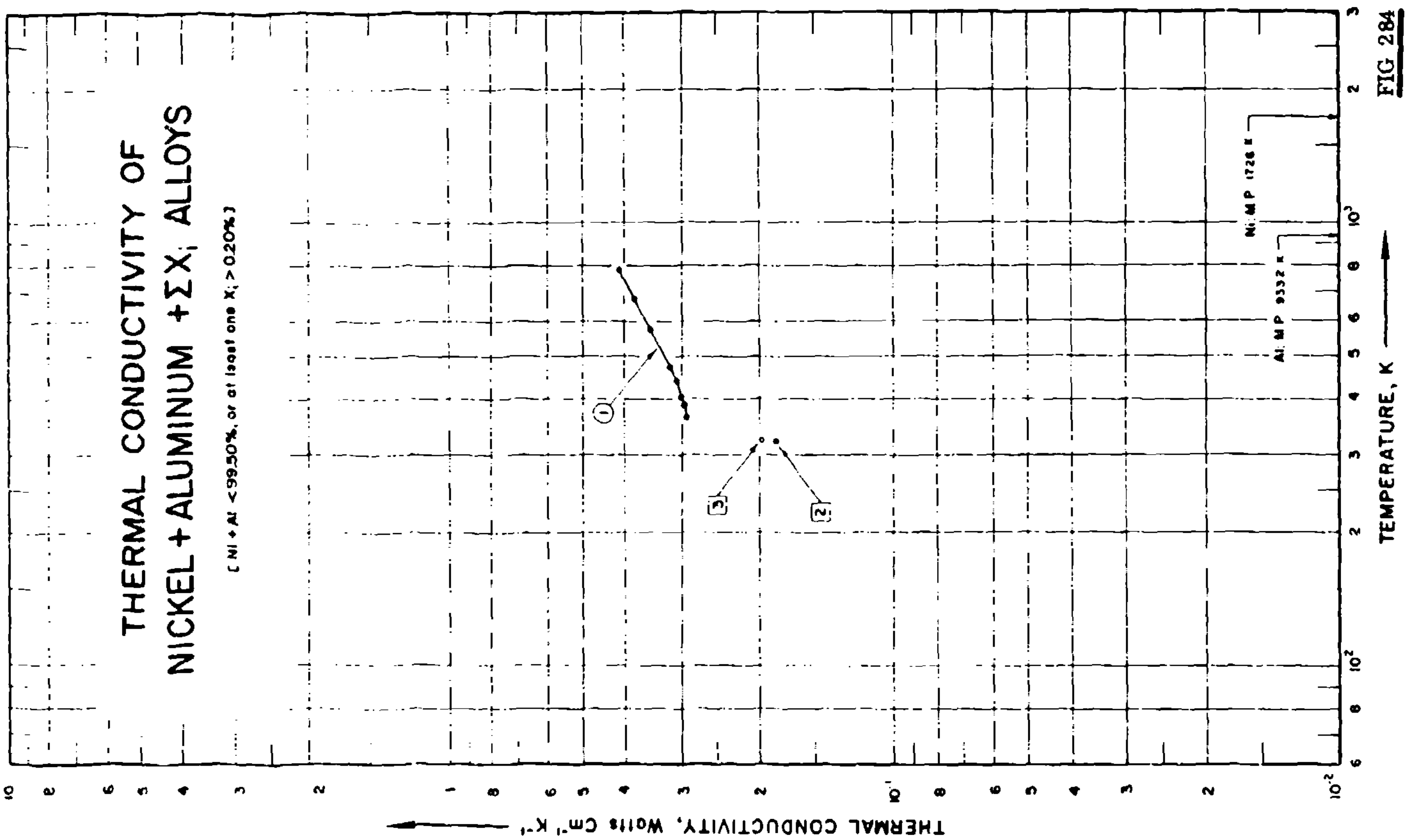

THERMAL CONDUCTIVITY OF
NICKEL + ALUMINUM + ΣXᵢ ALLOYS
(Ni + Al < 99.50%, or at least one Xᵢ > 0.20%)
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Ni M.P. 1726 K
Al M.P. 933.2 K
1
2
3

FIG 284

SPECIFICATION TABLE NO. 284 THERMAL CONDUCTIVITY OF [NICKEL + ALUMINUM + ΣX_i] ALLOYS

(Ni + Al > 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 284]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Al	Mn	Si	Fe	C	Cu	Composition (continued), Specifications and Remarks
1	129	C	1933	363-773	3-5	N_2 Alumel	95.0	2.0	2.0	1.0				Specimen 2 cm in dia and 15 cm long; supplied by Hoskins manufacturing Co.; machined and hot-rolled to 3/4 in. in dia; lead used as comparative material.
2	218		1956	323.2		Duranickel	93.0 Min.	4.4/ 4.75	0.5	1.0	0.6	0.3	0.25	0.25 - 1.0 Ti, 0.01 S; wrought, annealed; density 8.26 g cm^{-3}; electrical resistivity 290 ohms per cir mil ft.
3	218		1956	323.2		Duranickel	93.0 Min.	4.4/ 4.75	0.5	1.0	0.6	0.3	0.25	0.25 - 1.0 Ti, 0.01 S; wrought, age-hardened; electrical resistivity 260 ohms per cir mil ft.

DATA TABLE NO. 284 THERMAL CONDUCTIVITY OF [NICKEL + ALUMINUM + ΣX_i] ALLOYS

(Ni + Al > 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
363.4	0.293
389.2	0.297
405.1	0.301
441.3	0.307
473.2	0.318
573.2	0.359
673.2	0.381
773.2	0.412
CURVE 2	
323.2	0.185
CURVE 3	
323.2	0.198

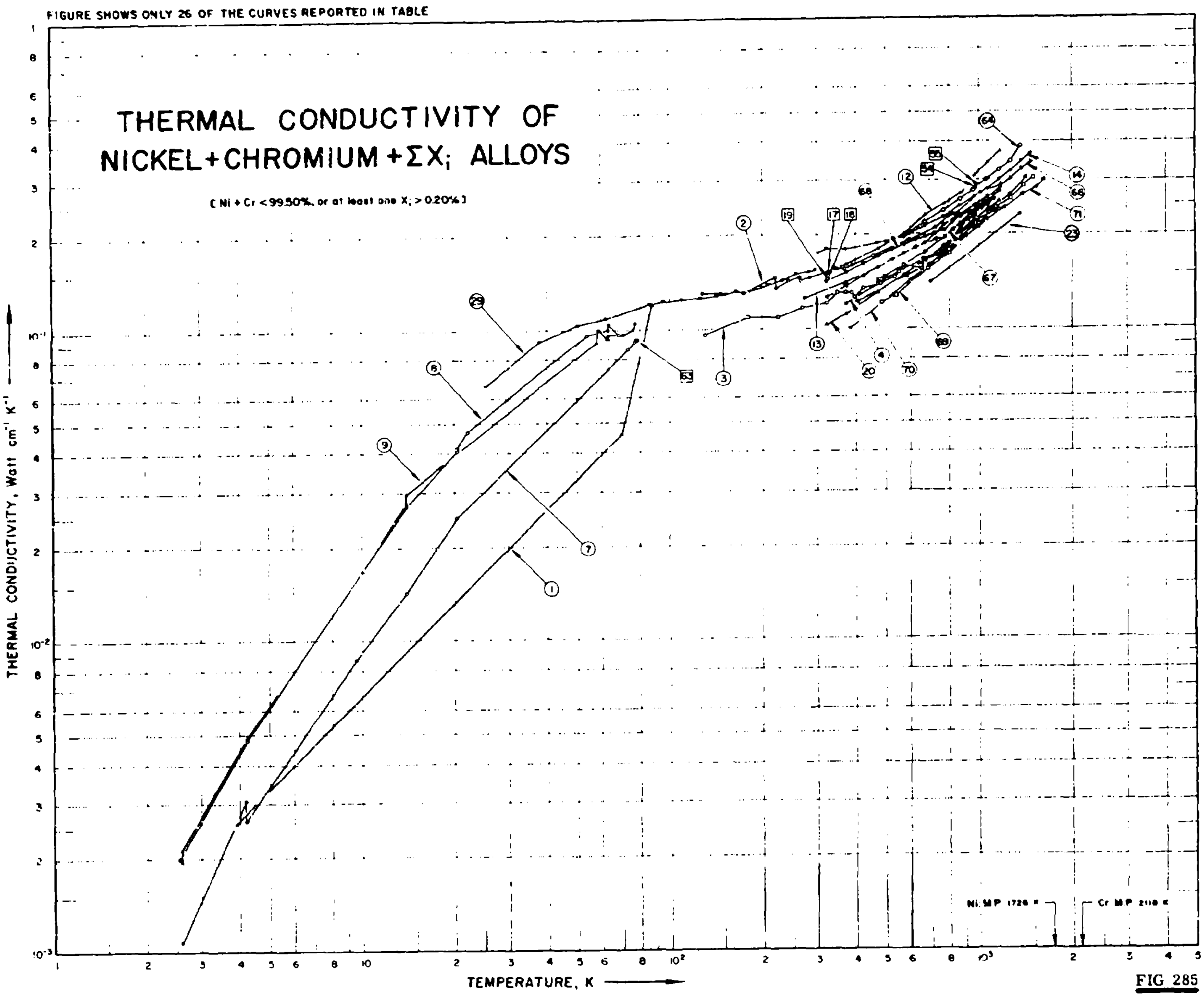


FIGURE SHOWS ONLY 26 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
NICKEL + CHROMIUM + ΣX; ALLOYS
(Ni + Cr < 99.50%, or at least one X; > 0.20%)
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ni: M.P. 1726 K
Cr M.P. 2118 K

FIG 285

SPECIFICATION TABLE NO. 285 THERMAL CONDUCTIVITY OF [NICKEL + CHROMIUM + ΣX_i] ALLOYS

($Ni + Cr < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 285]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Cr	Al	C	Cu	Fe	Mn	Si	Composition (continued), Specifications and Remarks
1	213	L	1950	3.9-88	2.0	Chroman	61.4	18.5				14.5	3.0	0.6	2.0 Mo.
2	91	C	1951	128-1189		Inconel	78.92	14.62		0.09	0.12	5.8	0.23	0.19	0.007 S; hot-rolled; annealed at 871-982 C for 3 hrs.
3	91	C	1951	131-1170		Inconel X	72.94	14.65	0.93	0.03	0.02	6.97	0.54	0.46	0.007 S; 1.01 Nb, and 2.44 Ti; hot-rolled; solution-treated at 1149 C for 3 hrs; aged at 843 C for 24 hrs and at 704 C for 20 hrs and air cooled.
4	214	L	1952	373-1173		Nimonic 80	72.8	21.4	0.38			3.08			2.34 Ti; heated to 1080 C for 8 hrs and aged at 700 C.
5	37	C	1951	377-845	4.0	Inconel X	73.4	14.6	0.7	0.05		6.9			2.3 Ti, 1.0 Nb.
6	37	C	1951	376-837	4.0	Nimonic 80	74.2	21.2	0.63	0.04					2.4 Ti.
7	155	L	1951	2.6-77		Inconel; 1									Commercial Inconel; hard-drawn tubing.
8	155	L	1951	2.6-77		Inconel; 2									Commercial Inconel; annealed tubing.
9	155	L	1951	2.6-78		Inconel; 3									Commercial Inconel; hot-rolled rod.
10	43	L	1958	876-1348	5.0	Hastelloy C	56.07	15.83		0.07		4.94			4.41 W, 14.57 Mo.
11	215	L	1939	373,473	2.0	Inconel	80.08	12.97		0.07	0.18	6.31	0.24	0.15	Hot-rolled.
12	216		1959	323-1173		Inconel X	69.0 Min	14.0/ 17.0	0.4/ 1.0	0.08 Max	0.5 Max	5.0/ 9.0	1.0 Max	0.5 Max	2.25-2.75 Ti, 0.7-1.2 Nb, 0.01(Max) S, 1.0 (Max) Co.
13	162	C	1936	273-1073		Nichrome	77.28	20.98		0.12		0.59	0.65	0.38	Forged and drawn.
14	163	L	1936	303-1473		German chromin; 20	82.25	12.98		0.09		3.05	0.88	0.75	Rolled.
15	163	L	1936	303-1373		German chromin; 21	75.15	19.93		0.04		1.94	1.81	1.13	Rolled.
16	217	C	1959	405-1044	4.0	Inconel	75.92	15.38				8.70			Obtained from commercial source in wrought form.
17	218		1956	323		Inconel	72.0 Min	14.0/ 17.0		0.15	0.5	6.0/ 10.0	1.0	0.5	0.015 S; annealed.
18	218		1956	323		Inconel X	70.0 Min	14.0/ 17.0	0.4/ 1.0	0.08	0.5	5.0/ 9.0	1.0	0.5	2.25-2.75 Ti, 0.01 S; age-hardened.

SPECIFICATION TABLE NO. 285 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Cr	Al	C	Cu	Fe	Mn	Si	Composition (continued), Specifications and Remarks
19	218		1956	323		Inconel	72.0 Min	14.0/ 17.0		0.15	0.5	6.0/ 10.0	1.0	0.5	0.015 S, as cast.
20	131	C	1953	323-1173	2.0	Nichrome V	77.94	19.87				0.036	0.06	1.44	Annealed at 950 C.
21	131	C	1953	323-1173	2.0	Inconel	78.13	13.94				6.33	0.32	0.33	0.30 Co; annealed at 1050 C.
22	91	C	1951	373-1073		Inconel									Commercial alloy produced by INCO.
23	195	C	1958	700,1367	10.0	80 Ni-20 Cr	79.52	19.33		0.31		0.17	0.03	0.64	Trace P; density 8.35 g cm^{-3}.
24	39	R	1958	336-1544	5.0	Hastelloy R-235	62.34	15.5	2.0	0.16		10.0	1.0		5.5 Mo, 2.5 Co, 1.0 Si; nominal composition; specimen (composed of 15 disks) 0.625 in. I.D., 3.0 in. O.D. and 9 in. long.
25	187		1955	373,1173		French nimonic 75	≈74	≈20		0.08/ 0.15	0.5 Max	≈2.4	1.0 Max	1.0 Max	0.2-0.6 Ti.
26	187		1955	373,1173		French nimonic 80/80A	≈71	≈2	0.51 1.8	0.1 Max	0.2 Max	≈5.0	1.0 Max	1.0 Max	1.8-2.7 Ti.
27	187		1955	373,1173		Nimonic 90	≈52	≈20	0.8/ 1.8	0.1 Max	0.2 Max	≈5.0	1.0 Max	1.0 Max	15-20 Co, 1.8-2.7 Ti.
28	187		1955	373,1173		Nimonic 95	≈56	≈19	1.6/ 1.85	0.12 Max	0.2 Max	1.0 Max	0.3 Max	1.0 Max	15-20 Co, 2.75-2.95 Ti.
29	219	L	1951	26-295	< 2.5	Inconel	80	14				6			Provided by International Nickel Co.
30	533	L	1955	373-973	< 2.0	Inconel									Composition not reported.
31	492	C	1960	323-1073		Nimonic 75	77.87	20.53		0.126	0.06	0.12	0.27	0.79	0.23 Ti.
32	492	C	1960	323-1173		Nimonic 80	73.66	21.0	1.20	0.04		0.50	0.60	0.50	2.5 Ti; nominal composition.
33	492	C	1960	323-1073		Nimonic 90	58.96	19.5	1.40	0.06	0.14	0.41	0.03	0.65	2.45 Ti, 16.5 Co.
34	492	C	1960	323-1073		Nimonic 95	57.71	19.1	1.99	0.10	0.06	0.38	0.06	0.65	2.91 Ti, 16.5 Co.
35	534	E	1958	373-973	3.0	Russian Kh80T	74.5	20.9	0.4	0.05			0.46	0.70	2.28 Ti.
36	534	E	1958	373-973	3.0	Russian Kh80T	74.5	20.9	0.4	0.05			0.46	0.70	2.28 Ti; tempered at 850 C for 100 hrs.
37	534	E	1958	373-973	3.0	Russian Kh80T	74.5	20.9	0.4	0.05			0.46	0.70	2.26 Ti; tempered at 850 C for 2000 hrs.
38	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.50	0.42	0.49 Ti, 1.67 Nb; heat at 1100 C for 5 hrs and water-quenched.

SPECIFICATION TABLE NO. 285 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Cr	Al	C	Cu	Fe	Mn	Si	Composition (continued), Specifications and Remarks
39	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; the above specimen heated again at 1000 C for 2 hrs and air-cooled.
40	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; the above specimen heated again at 900 C for 1 hr and again at 800 C for 2 hrs.
41	534	E	1958	[illegible].2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; the above specimen heated again at 750 C for 20 hrs.
42	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; the above specimen heated again at 700 C for 48 hrs.
43	534	E	1958	373-973	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; the above specimen.
44	534	E	1958	373-973	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; the above specimen tempered at 700 C for 50 hrs.
45	534	E	1958	373-973	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; the above specimen tempered at 700 C for 200 hrs.
46	534	E	1958	373-973	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; the above specimen tempered at 700 C for 1000 hrs.
47	534	E	1958	373-973	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; the above specimen tempered at 700 C for 2000 hrs.
48	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; tempered at 650 C for 1000 hrs.
49	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; tempered at 650 C for 2000 hrs.
50	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; tempered at 700 C for 1000 hrs.
51	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; tempered at 700 C for 2000 hrs.

SPECIFICATION TABLE NO. 285 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Cr	Al	C	Cu	Fe	Mn	Si	Composition (continued), Specifications and Remarks
52	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; tempered at 750 C for 1000 hrs.
53	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; tempered at 750 C for 2000 hrs.
54	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; tempered at 800 C for 1000 hrs.
55	534	E	1958	973.2	3.0	EI-607	80.95	15.4	0.55	0.02			0.5	0.42	0.49 Ti, 1.67 Nb; tempered at 800 C for 2000 hrs.
56	467		1953	317-407	± 5.0	Inconel	80.0	15.0				5.0			Nominal composition from Metals Handbook.
57	467		1953	317-417	± 5.0	Inconel	80.0	15.0				5.0			Nominal composition from Metals Handbook.
58	535	L	1958	818-1149		Inconel	80.0	15.0				5.0			Nominal composition from Metals Handbook.
59	536	L	1955	366-1033	± 7.0	Inconel	75.99	14.42		0.02	0.22	8.87	0.28	0.17	0.007 S; annealed at 2050 F followed by cooling in quiescent air; Rockwell superficial hardness (15 T scale) = 78.
60	536	L	1955	366-1033	± 5.0	Inconel	76.45	14.96		0.07	0.15	7.89	0.26	0.19	0.007 S; annealed at 2050 F followed by cooling in quiescent air; Rockwell superficial hardness (15 T scale) = 80.
61	536	L	1955	366-1033	± 5.0	Inconel	75.64	15.32		0.11	0.19	8.17	0.33	0.21	0.007 S; annealed at 2050 F followed by cooling in quiescent air; Rockwell superficial hardness (15 T scale) = 83.
62	490	F	1950	273-1173		Inconel	73.19	14.38	0.83	0.03	0.03	6.99	0.47	0.39	0.007 S; cylindrical bar 0.3175 cm in radius and 30 cm long.
63	537		1940	78.2		Nichrome	76.98	≈20		→		→	→	→	Others are Mn, C, Si and Fe; forged; commercial heat resistant alloy; measured in the boiling nitrogen bath.
64	163	L	1936	303-1373		19	62.85	16.95		0.12			1.00	0.51	Rolled.
65	673	E	1932	309.6	± 1.3		70	18				12			

SPECIFICATION TABLE NO. 285 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Cr	Al	C	Cu	Fe	Mn	Si	Composition (continued), Specifications and Remarks
66	596	L	1962	473-1473		Inconel 702	79.3	17.0	2.5	0.066	0.14	0.36	0.04	0.19	0.59 Ti and 0.08 Co; machined at NBS from the solution annealed hot-rolled plate into the form of a right circular cylinder 2.539 cm in dia and 7.5 cm long with recesses at either end; the solution annealing for this alloy is to hold the material at 1080 C for one hr, followed by rapid air cooling.
67	686		1963	323-973	± 2.0	OKh 20 N 60 B	59.64	20.4		0.06		17.7	1.59	0.25	0.58 Nb and 0.004 S; quenched in water from 1050 C and then tempered in air at 720 C for one hr.
68	686		1963	323-1123	± 2.0	El-435	77.33	21.1		0.06	Trace	0.56	0.49	0.32	0.23 Ti, 0.006 S and 0.005 P; quenched in water from 1100 C.
69	614	R	1961	486-1501	< 5	INCO 713C	71.53	11.0	6.5	0.20		5.0	1.0	1.0	1.0 Nb + Ta, 3.5 Mo, 0.25 Ti; specimen contained 5 one-in. dia disks.
70	614	R	1961	386-1427	< 5	M252	57.15	18.65	1.17	0.12	9.75	< 0.30	0.07	0.06	9.98 Mo, 2.74 Ti; specimen contained 5 one-in. dia disks.
71	614	R	1961	406-1617	< 5	Rene 41	54.60	18.60	1.49	0.11	10.73	1.54	0.08	0.07	9.63 Mo, 3.14 Ti; specimen contained 5 one-in. dia disks.
72	973	L	1966	326-513	< 6	Nimocast 713C	Bal	13.5	6.04	0.11					0.008 B, 4.65 Mo, 2.3 Nb, 0.95 Ti, and 0.10 Zr; specimen 1.27 cm in dia and 15 cm long; as cast; electrical resistivity 143.8, 144.1, 146.2, 149.3 and 151 μohm cm at 20, 50, 100, 200 and 250 C, respectively.

DATA TABLE NO. 285 THERMAL CONDUCTIVITY OF [NICKEL + CHROMIUM + ΣX_i] ALLOYS

($Ni + Cr < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
3.90	0.0026
70.00	0.046
88.00	0.120
CURVE 2	
128.3	0.130
175.2	0.130
220.5	0.146
221.5	0.134
243.1	0.142
265.6	0.146
265.8	0.142
287.6	0.146
327.3	0.151
348.9	0.155
370.1	0.155
390.8	0.159
459.1	0.172
593.7	0.192
599.5	0.192
725.6	0.209
822.2	0.230
841.1	0.230
1015.7	0.272
1189.1	0.289
CURVE 3	
131.1	0.0962
180.1	0.109
226.0	0.109
269.9	0.117
324.6	0.121
349.5	0.130
373.5	0.130
390.4	0.130
397.7	0.126
426.9	0.134
485.4	0.138
551.8	0.151
573.7	0.146
573.8	0.159
657.6	0.155
664.4	0.167
CURVE 3 (cont.)	
769.1	0.176
804.2	0.188
997.9	0.222
1169.8	0.238
CURVE 4	
373.2	0.121
473.2	0.138
573.2	0.155
673.2	0.167
773.2	0.184
873.2	0.209
973.2	0.234
1073.2	0.255
1173.2	0.276
CURVE 5*	
376.6	0.161
419.9	0.165
451.0	0.179
461.9	0.177
502.4	0.184
504.4	0.188
525.1	0.188
538.9	0.191
559.1	0.197
664.2	0.218
677.4	0.216
692.4	0.222
733.7	0.233
751.6	0.229
772.2	0.239
786.1	0.240
837.8	0.256
844.9	0.249
CURVE 6*	
376.1	0.163
422.0	0.174
477.6	0.186
533.2	0.196
588.7	0.207
CURVE 6 (cont.)	
644.3	0.216
699.8	0.225
755.4	0.234
810.9	0.241
836.5	0.244
CURVE 7	
2.6	0.00108
4.2	0.00306
4.2	0.00265
9.6	0.0087
14.0	0.0143
20.4	0.0248
63.3	0.0744
73.4	0.0866
77.0	0.0910
CURVE 8	
2.55	0.00200
4.25	0.00483
14.0	0.0270
20.5	0.0407
20.5	0.0415
22.1	0.0470
54.0	0.0963
63.3	0.100
63.7	0.104
68.4	0.0966
77.0	0.110
CURVE 9	
2.59	0.00196
2.59	0.00213
4.25	0.00489
4.25	0.00493
10.1	0.0168
14.0	0.0277
14.0	0.0297
58.0	0.0910
58.7	0.0997
59.2	0.0997
63.0	0.0935
CURVE 9 (cont.)	
63.3	0.0935
63.3	0.0962
70.6	0.0965
76.2	0.100
77.8	0.107
CURVE 10*	
876.0	0.192
1005.0	0.254
1006.7	0.254
1072.3	0.277
1072.3	0.277
1150.4	0.284
1150.4	0.284
1229.0	0.292
1348.3	0.299
CURVE 11*	
373.2	0.155
473.2	0.188
CURVE 12	
323.2	0.15
373.2	0.16
473.2	0.18
573.2	0.20
673.2	0.23
773.2	0.25
873.2	0.27
973.2	0.31
1073.2	0.34
1173.2	0.37
CURVE 13	
273.2	0.126
373.2	0.140
473.2	0.157
573.2	0.174
673.2	0.188
773.2	0.213
873.2	0.230
CURVE 13 (cont.)	
973.2	0.247
1073.2	0.264
CURVE 14	
303.2	0.176
323.2	0.180
373.2	0.180
473.2	0.188
573.2	0.197
673.2	0.213
773.2	0.226
873.2	0.247
973.2	0.264
1073.2	0.280
1173.2	0.301
1273.2	0.322
1373.2	0.343
1473.2	0.364
CURVE 15*	
303.2	0.151
323.2	0.155
373.2	0.163
473.2	0.176
573.2	0.188
673.2	0.201
773.2	0.213
873.2	0.226
973.2	0.243
1073.2	0.255
1173.2	0.272
1273.2	0.297
1373.2	0.331
CURVE 16*	
404.8	0.155
440.3	0.155
479.5	0.163
516.2	0.176
551.3	0.184
566.8	0.184
617.5	0.188
CURVE 16 (cont.)	
637.8	0.192
724.4	0.205
725.7	0.201
804.1	0.230
830.1	0.222
905.4	0.255
924.9	0.247
1043.6	0.272
CURVE 17	
323.2	0.150
CURVE 18	
323.2	0.147
CURVE 19	
323.2	0.144
CURVE 20	
323.2	0.103
373.2	0.112
473.2	0.130
573.2	0.148
673.2	0.166
773.2	0.183
873.2	0.201
973.2	0.220
1073.2	0.238
1173.2	0.255
CURVE 21*	
323.2	0.111
373.2	0.119
473.2	0.136
573.2	0.152
673.2	0.169
773.2	0.185
873.2	0.202
973.2	0.218
1073.2	0.235
1173.2	0.251
CURVE 22*	
373.2	0.163
473.2	0.172
573.2	0.180
673.2	0.188
773.2	0.201
873.2	0.209
973.2	0.218
1073.2	0.226
CURVE 23	
699.9	0.140
1366.5	0.231
CURVE 24*	
336.2	0.111
378.8	0.118
452.1	0.127
598.3	0.152
685.1	0.166
846.8	0.185
1073.5	0.214
1237.7	0.251
1416.8	0.272
1543.7	0.292
CURVE 25*	
373.2	0.134
1173.2	0.297
CURVE 26*	
373.2	0.121
1173.2	0.285
CURVE 27*	
373.2	0.126
1173.2	0.289
CURVE 28*	
373.2	0.126
1173.2	0.289
CURVE 29	
25.48	0.0657
37.94	0.0920
50.59	0.104
62.18	0.108
86.20	0.120
95.18	0.122
109.88	0.124
126.97	0.126
142.94	0.127
153.44	0.129
164.92	0.131
174.49	0.130
181.06	0.132
199.87	0.135
214.13	0.137
234.27	0.142
256.92	0.149
281.59	0.151
295.38	0.154
CURVE 30*	
373.2	0.136
473.2	0.149
573.2	0.164
673.2	0.180
773.2	0.198
873.2	0.218
973.2	0.240
CURVE 31*	
323.2	0.132
373.2	0.139
473.2	0.157
573.2	0.175
673.2	0.191
773.2	0.210
873.2	0.226
973.2	0.243
1073.2	0.260

*Not shown on plot

DATA TABLE NO. 285 (continued)

T	k
CURVE 32*	
323.2	0.114
373.2	0.121
473.2	0.138
573.2	0.155
673.2	0.158
773.2	0.184
873.2	0.210
973.2	0.235
1073.2	0.255
1173.2	0.276
CURVE 33*	
323.2	0.121
373.2	0.130
473.2	0.146
573.2	0.165
673.2	0.184
773.2	0.200
873.2	0.218
973.2	0.237
1073.2	0.253
CURVE 34*	
323.2	0.117
373.2	0.125
473.2	0.141
573.2	0.160
673.2	0.175
773.2	0.188
873.2	0.203
973.2	0.221
1073.2	0.241
CURVE 35*	
373.2	0.135
573.2	0.177
773.2	0.220
973.2	0.268
CURVE 36*	
373.2	0.132
CURVE 36(cont.)*	
573.2	0.161
773.2	0.209
973.2	0.259
CURVE 37*	
373.2	0.140
573.2	0.167
773.2	0.209
973.2	0.266
CURVE 38*	
973.2	0.259
CURVE 39*	
973.2	0.259
CURVE 40*	
973.2	0.262
CURVE 41*	
973.2	0.255
CURVE 42*	
973.2	0.254
CURVE 43*	
373.2	0.146
573.2	0.199
773.2	0.230
973.2	0.268
CURVE 44*	
373.2	0.126
573.2	0.167
773.2	0.213
973.2	0.251
CURVE 45*	
373.2	0.126
573.2	0.167
773.2	0.218
973.2	0.255
CURVE 46*	
373.2	0.126
573.2	0.167
773.2	0.213
973.2	0.255
CURVE 47*	
373.2	0.126
573.2	0.167
773.2	0.209
973.2	0.251
CURVE 48*	
973.2	0.268
CURVE 49*	
973.2	0.274
CURVE 50*	
973.2	0.264
CURVE 51*	
973.2	0.253
CURVE 52*	
973.2	0.272
CURVE 53*	
973.2	0.253
CURVE 54	
973.2	0.283
CURVE 55	
973.2	0.291
CURVE 56*	
316.6	0.136
344.2	0.137
358.5	0.143
379.6	0.145
407.0	0.150
CURVE 57*	
317.4	0.135
337.4	0.134
359.0	0.141
380.5	0.142
417.0	0.149
CURVE 58*	
818.2	0.210
841.2	0.228
847.2	0.218
898.2	0.233
898.2	0.238
912.2	0.242
914.2	0.248
959.2	0.252
961.2	0.256
970.2	0.255
1009.2	0.262
1047.2	0.268
1072.2	0.273
1083.2	0.273
1149.2	0.276
CURVE 59*	
366.2	0.150
477.2	0.162
588.2	0.181
CURVE 59(cont.)*	
699.2	0.199
811.2	0.221
921.2	0.243
1033.2	0.255
CURVE 60*	
366.2	0.150
477.2	0.165
588.2	0.184
699.2	0.204
811.2	0.224
921.2	0.246
1033.2	0.259
CURVE 61*	
366.2	0.150
477.2	0.165
588.2	0.184
699.2	0.206
811.2	0.227
921.2	0.249
1033.2	0.260
CURVE 62*	
273.2	0.134
373.2	0.159
473.2	0.180
573.2	0.201
673.2	0.226
773.2	0.251
873.2	0.272
973.2	0.305
1073.2	0.339
1173.2	0.372
CURVE 63	
78.2	0.092
CURVE 64	
303.2	0.176*
323.2	0.176*
373.2	0.180*
473.2	0.188*
573.2	0.200*
673.2	0.218
773.2	0.238
873.2	0.259
973.2	0.280
1073.2	0.301
1173.2	0.322
1273.2	0.343
1373.2	0.385
CURVE 65	
309.6	1.176
CURVE 66	
473.2	0.142
479.2	0.142
497.2	0.145
671.2	0.175
675.2	0.176
775.2	0.194
873.2	0.215
875.2	0.218
980.2	0.238
1078.2	0.260
1177.2	0.282
1273.2	0.301
1273.2	0.304
1375.2	0.324
1473.2	0.340
CURVE 67	
323.2	0.126
373.2	0.137
423.2	0.147
473.2	0.156
523.2	0.165
573.2	0.173
623.2	0.181
CURVE 67 (cont.)	
673.2	0.188
723.2	0.192
773.2	0.196
823.2	0.205
873.2	0.214
923.2	0.220
973.2	0.226
CURVE 68	
323.2	0.141
373.2	0.151
423.2	0.161
473.2	0.170
523.2	0.178
573.2	0.185
623.2	0.192
673.2	0.197
723.2	0.200
773.2	0.205
823.2	0.217
873.2	0.228
923.2	0.234
973.2	0.238
1023.2	0.240
1073.2	0.248
1123.2	0.258
CURVE 69	
485.9	0.121
539.8	0.127
683.7	0.154
800.9	0.173
1000.9	0.214
1144.8	0.241
1272.1	0.259
1400.9	0.286
1500.9	0.304
CURVE 70	
385.9	0.100
602.1	0.142
690.9	0.159

* Not shown on plot

DATA TABLE NO. 285 (continued)

T	k
CURVE 70 (cont.)	
765.9	0.173*
872.6	0.194*
992.1	0.217
1106.5	0.241
1255.9	0.267
1427.1	0.305
CURVE 71	
405.9	0.122
585.4	0.147
753.2	0.168
907.6	0.196
994.3	0.210
1060.4	0.220
1212.1	0.241
1392.1	0.267
1534.8	0.280
1617.1	0.300
CURVE 72*	
326.2	0.108
330.2	0.108
330.2	0.107
331.2	0.107
340.2	0.108
342.2	0.110
345.2	0.110
355.2	0.108
383.2	0.112
388.2	0.114
398.2	0.114
403.2	0.116
408.2	0.115
436.2	0.120
439.2	0.120
464.2	0.124
513.2	0.130

*Not shown on plot

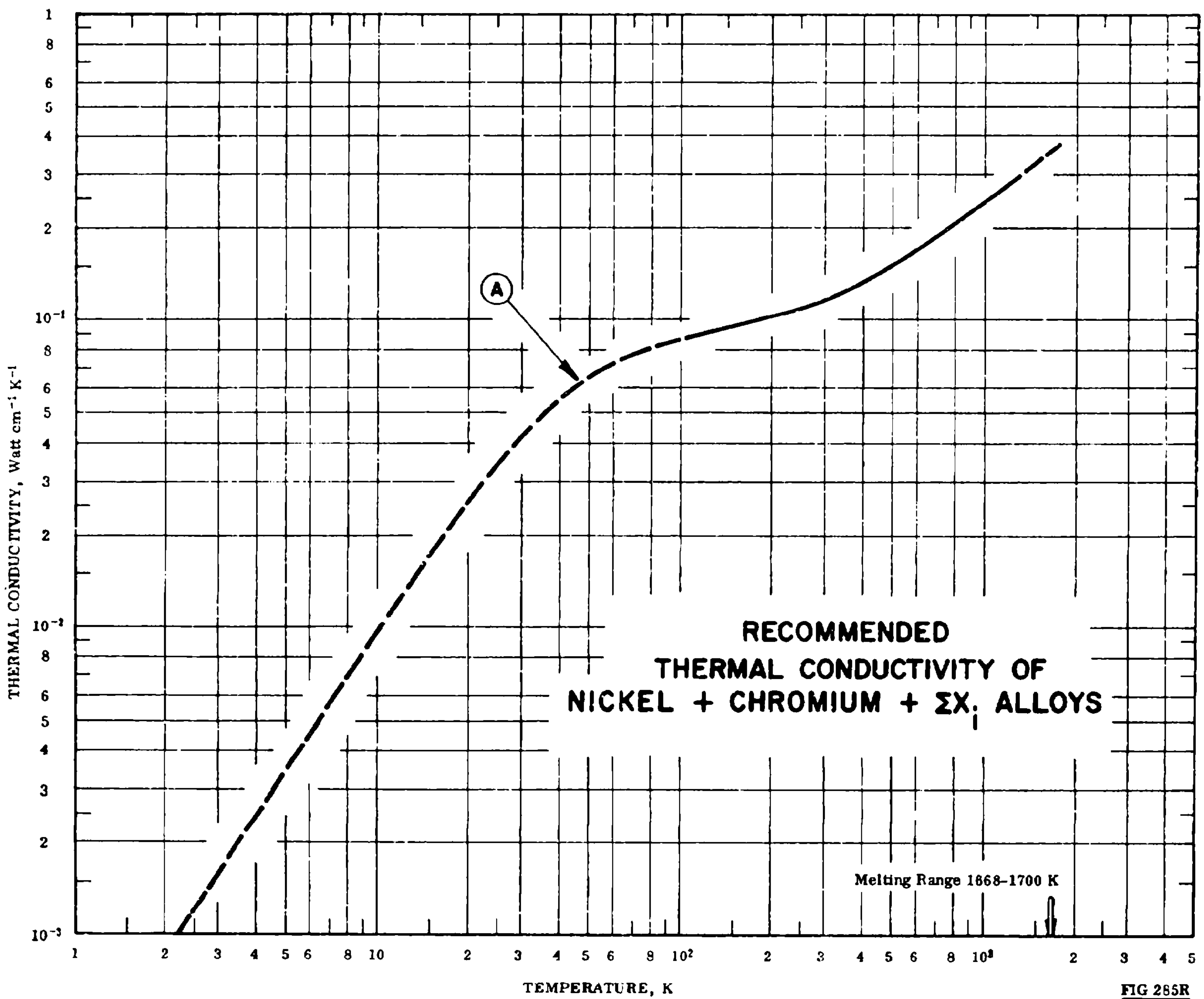

RECOMMENDED
THERMAL CONDUCTIVITY OF
NICKEL + CHROMIUM + ΣX_i ALLOYS
A
Melting Range 1668–1700 K
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
1
8
6
5
4
3
2
10^{-1}
10^{-2}
10^{-3}
10
10^2
10^3

FIG 285R

SPECIFICATION TABLE NO. 285R RECOMMENDED THERMAL CONDUCTIVITY OF [NICKEL + CHROMIUM + ΣX_i] ALLOYS

[For Data Reported in Figure and Data Table No. 285R]

Curve No.	Name and Designation	Nominal Composition (weight percent) and Remarks	Estimated Error
A	Inconel X-750 (previously designated as Inconel X)	73.0 Ni, 15 Cr, 6.75 Fe, 2.50 Ti, 0.85 Nb, 0.80 Al, 0.70 Mn, 0.30 Si, 0.05 Cu, 0.04 C and 0.007 S; fully heat treated.	± 10% below 100 K, ± 5% from 200 to 1000 K, and ± 10% above 1400 K.

DATA TABLE NO. 285R RECOMMENDED THERMAL CONDUCTIVITY OF [NICKEL + CHROMIUM + ΣX_i] ALLOYS

[Temperature, T_1 in K and T_2 in F; Thermal Conductivity, k_1 in Watt $cm^{-1} K^{-1}$ and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$]

T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2	T_1	k_1	k_2	T_2
	CURVE A				CURVE A (cont.)				CURVE A (cont.)		
0	0	0	-459.7	300	0.117	6.75	80.3	1500	(0.328)	(19.0)	2240
1	(0.0.00024)‡	(0.0139)	-457.9	350	0.126	7.28	170.3	1600	(0.346)	(20.0)	2420
3	(0.00145)	(0.0838)	-454.3	400	0.135	7.80	260.3	1665	(0.358)	(20.7)	2537
5	(0.0033)	(0.191)	-450.7	450	0.143	8.26	350.3				
10	(0.0096)	(0.555)	-441.7	500	0.152	8.78	440.3				
25	(0.031)	(1.96)	-414.7	600	0.170	9.82	620.3				
50	(0.066)	(3.81)	-369.7	700	0.188	10.9	800.3				
75	(0.080)	(4.62)	-324.7	800	0.205	11.8	980.3				
				900	0.223	12.9	1160				
100	(0.087)	(5.03)	-279.7								
150	0.096	5.55	-189.7	1000	0.240	13.9	1340				
200	0.105	5.95	- 99.7	1100	0.258	14.9	1520				
250	0.110	6.36	- 9.7	1200	0.276	15.9	1700				
273.2	0.113	6.53	32.0	1300	(0.293)	(16.9)	1880				
				1400	(0.311)	(18.0)	2060				

‡ Values in parentheses are extrapolated.

THERMAL CONDUCTIVITY OF NICKEL + COBALT + ΣX_i ALLOYS

[Ni + Co ≥ 99.50%; impurity ≤ 0.20% each]

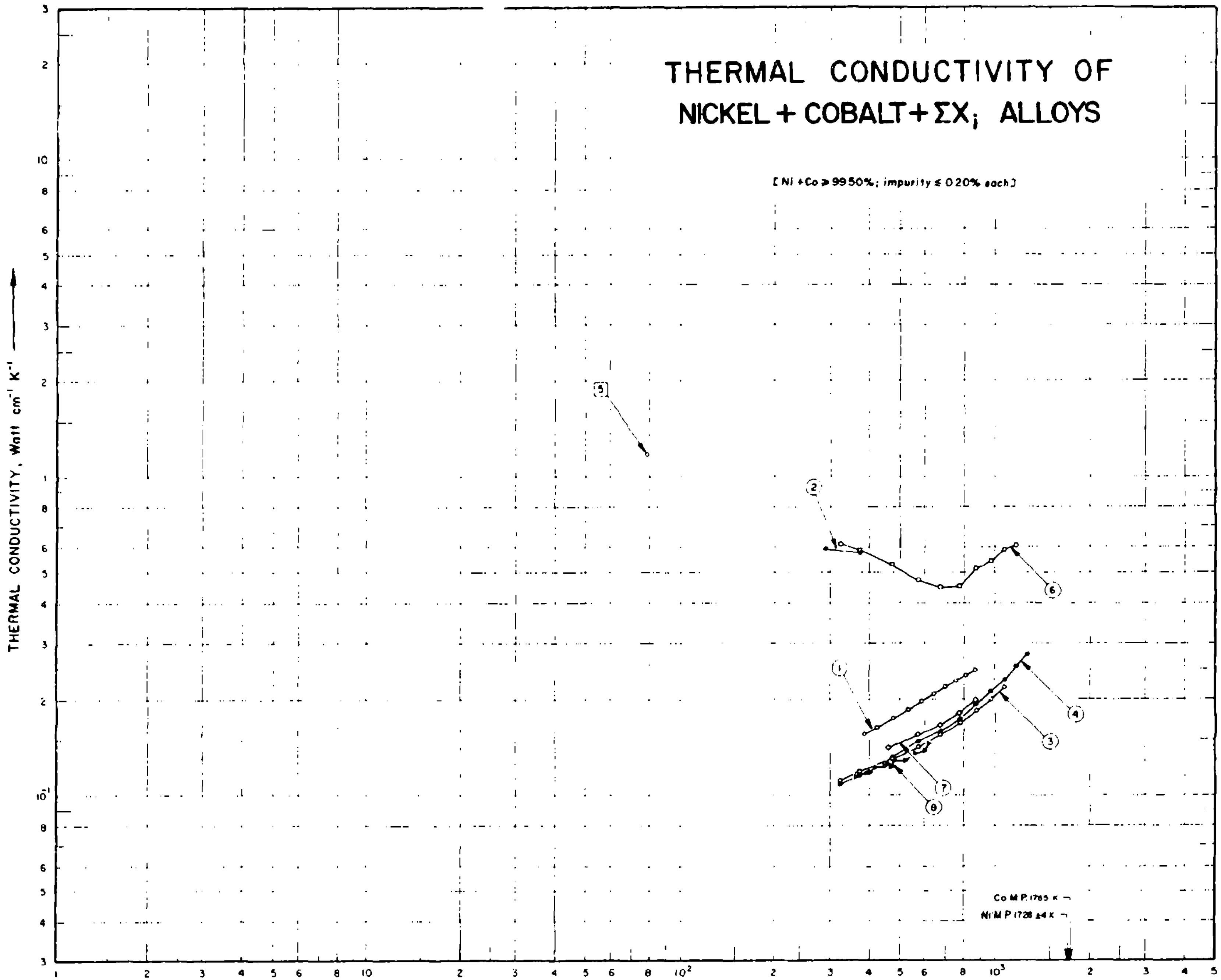


FIG 286

SPECIFICATION TABLE NO. 286 THERMAL CONDUCTIVITY OF [NICKEL + COBALT + ΣX_i] ALLOYS

($Ni + Co + \Sigma X_i < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 286]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Co	Al	Cr	Fe	Mn	Mo	Ti	Composition (continued), Specifications and Remarks
1	37	C	1951	385-865	4.0	Refralloy 26	37.0	20.0	0.3	18.0	18.67		3.0	3.0	0.03 C.
2	77	E	1900	291, 373			97.0	1.4			0.4	1.0			0.1 Si, 0.1 Cu.
3	492	C	1960	323-1073		Nimonic 100	Bal	20.0	5.22	11.1	0.18	0.03	5.0	1.07	0.28 Si, 0.24 C, 0.04 Cu.
4	492	C	1960	323-1273		Nimonic 105	Bal	18.0/ 22.0	4.0/ 6.0	14.0/ 16.0	3.0 Max	1.0 Max	4.0/ 6.0	0.5/ 2.5	1.0 (Max) Si, 0.3 (Max) C, 0.5 (Max) Cu.
5	433	L	1940	78.2			99.4	0.53	0.02		0.05				Electrolytic.
6	131	C	1953	323-1173	± 2.0	AN_1	98.19	0.746			0.26		0.705		0.063 Cu, 0.036 P; annealed at 900 C.
7	616		1947	473-873		Haynes Stellite No. 27	Bal	30 Min		23/ 29	2 Max		5/ 7		0.35-0.50 C; density 8.21 g cm^{-3}.
8	973	L	1966	363-616	<6	Nimonic 115	Bal	14.8	4.82	14.0	0.27	0.05	4.07	3.9	0.012 B, 0.17 C, <0.03 Cu, 0.16 Si, 0.04 Zr; specimen 1.27 cm in dia and 5 cm long; fully heat treated; electrical resistivity 141.2, 142.9, 146.1, 149.2 and 151 μohm cm at 50, 100, 200, 300 and 350 C, respectively.

DATA TABLE NO. 286 THERMAL CONDUCTIVITY OF [NICKEL + COBALT + ΣX_i] ALLOYS

(Ni + Co + ΣX_i <99.50% or at least one X_i >0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		CURVE 5	
385.4	0.156	78.2	1.180
422.0	0.164		
477.6	0.175	CURVE 6	
533.2	0.186		
588.7	0.197	323.2	0.610
644.3	0.208	373.2	0.582
699.8	0.218	473.2	0.525
755.4	0.228	573.2	0.470
810.9	0.237	673.2	0.446
865.4	0.246	773.2	0.447
		873.2	0.509
CURVE 2		973.2	0.540
		1073.2	0.587
291.2	0.594	1173.2	0.604
373.2	0.579		
		CURVE 7	
CURVE 3			
		473.2	0.141
323.2	0.112	573.2	0.155
373.2	0.118	673.2	0.166
473.2	0.130	773.2	0.181
573.2	0.142	873.2	0.198
673.2	0.155		
773.2	0.169	CURVE 8	
873.2	0.184		
973.2	0.200	363.2	0.114
1073.2	0.218	402.2	0.117
		417.2	0.122
CURVE 4		448.2	0.123
		459.2	0.125
323.2	0.108	465.2	0.122
373.2	0.116	480.2	0.128
473.2	0.131	523.2	0.128
573.2	0.147	559.2	0.135
673.2	0.159	598.2	0.138
773.2	0.174	598.2	0.139*
873.2	0.193	616.2	0.145
973.2	0.212	616.2	0.147*
1073.2	0.230		
1173.2	0.253		
1273.2	0.276		

*Not shown on plot

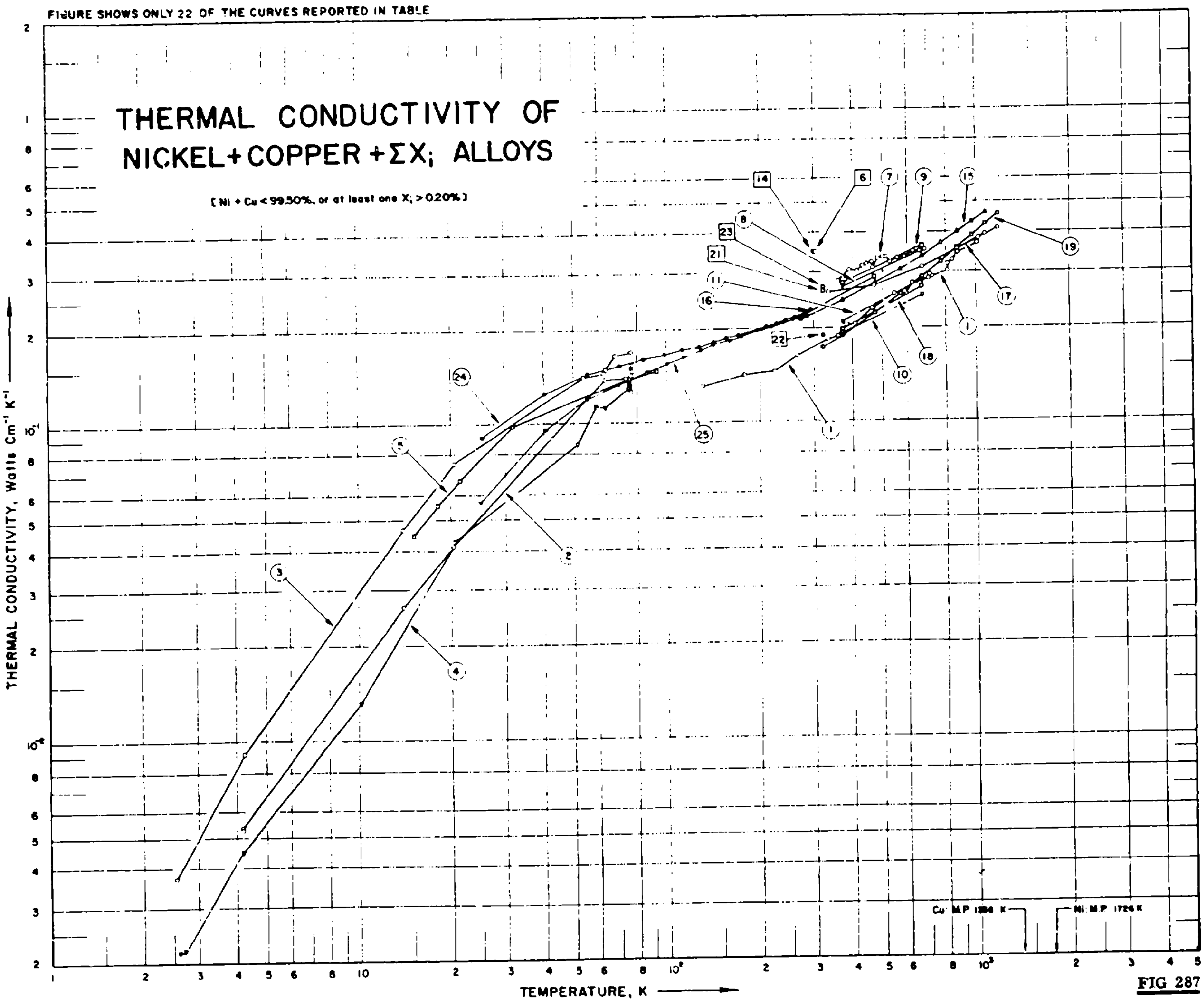


FIGURE SHOWS ONLY 22 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
NICKEL+COPPER+ΣX; ALLOYS
[Ni + Cu < 99.50%, or at least one Xi > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Cu M.P. 1356 K
Ni M.P. 1726 K

FIG 287

SPECIFICATION TABLE NO. 287 THERMAL CONDUCTIVITY OF (NICKEL + COPPER + ΣX_i) ALLOYS

(Ni + Cu < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 287]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Cu	Al	C	Fe	Mn	Si	Composition (continued) Specifications and Remarks
							Composition (weight per cent)							
1	91	C	1951	132-1186		"K" Monel	65.31	29.23	3.02	0.13	0.86	0.60	0.09	0.005 S; hot-rolled, annealed at 1650 F for 1 hr and water-quenched.
2	155	L	1951	4.2- 77		Monel; 1								Commercial Monel; hard-drawn tubing.
3	155	L	1951	2.6- 77		Monel; 2								Commercial Monel; annealed tubing.
4	155	L	1951	2.6- 77		Monel; 3								Commercial Monel; hard-drawn rod.
5	104	L	1951	15- 93		Monel	67.0	30.2						And other alloying elements; as forged.
6	186	P	1928	305		Monel	70.0	28.0			2.0			
7	30	L	1925	361- 688	2.0	Monel	67.05	29.07			2.68	0.84	0.3	As forged.
8	215	L	1939	373, 673	2.0	Monel	67.05	29.07			2.68	0.84	0.3	As cast.
9	215	L	1939	373, 673	2.0	Monel	67.34	29.46		0.21	1.79	1.11	0.07	Hot-rolled.
10	215	L	1939	373, 673	2.0	"K" Monel	66.73	29.76	2.50	0.20	0.35	0.21	0.25	As cast.
11	215	L	1939	373, 673	2.0	"SI" Monel	65.39	28.71		0.41	1.86	1.54	2.09	As cast.
12	215	L	1939	373, 673	2.0	"Si" Monel	64.04	28.32		0.33	2.15	1.74	3.37	As cast.
13	215	L	1939	373, 673	2.0	"Ni" Bronze	51.37	37.86						9.91 Sn, 0.86 Zn; as cast.
14	178	E	1918	303		17a	92.3	4.2		0.29	2.45	0.35	0.15	0.24 Co, 0.017 S; annealed at 900 C.
15	162	C	1936	273-1073		Monel	67.10	29.18	0.04	0.16	1.72	0.98	0.01	0.33 Co, 0.014 S, 0.13 Mg, 0.024 P; hot-rolled, black surface.
16	162	C	1936	273, 473		Corronil	68.41	28.94	0.16	0.1	0.6	1.17	0.4	Forged and drawn.
17	220		1960	337-1073		R-Monel	67.0	30.0		0.15	1.40	1.0	0. [illegible]	0.035 S; (Nominal composition).
18	221		1954	373, 673		S-Monel	62.0/ 68.0	Bal		0.25	<3.5	0.5/ 1.5	3.5/ 5.0	(Nominal composition.)
19	131	C	1953	323-1173	2.0	Monel	66.2	30.0		0.4	1.88	0.919	0.135	0.407 Co, 0.032 Mg; annealed at 950 C.
20	222		1954	373, 673		Cast Monel	62.0/ 68.0	Bal		0.35 Max	>2.5	0.5/ 1.5	1.0/ 2.24	
21	218		1956	323		Monel	63.0/ 70.0	Bal		0.3	2.5	2.0	0.5	0.01 S; hot-rolled.
22	218		1956	323		"K" Monel	63.0/ 70.0	Bal	2.0/ 4.0	0.25	2.0	1.5	1.0	0.25 - 1.0 Ti, 0.01 S; wrought; age-hardened.
23	218		1956	323		"H" Monel	61.0/ 68.0	Bal		0.3	2.5	0.5/ 1.5	2.7/ 3.7	0.05 S; as cast.
24	219	L	1951	26- 295	<2.5	Monel	67.0	30.0		0.15	1.4	1.0	0.1	0.01 S; hot-rolled.
25	219	L	1951	26- 289	<2.5	Monel	67.0	30.0		0.15	1.4	1.0	0.1	0.01 S; cold-rolled; provided by International Nickel Co.

SPECIFICATION TABLE NO. 297 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Cu	Al	C	Fe	Mn	Si	Composition (continued), Specifications and Remarks
							Composition (weight percent)							
26	433	L	1940	78		No. 0	94.77	4.36	0.02		0.08	0.26		0.51 Co, 0.01 Sb, trace S, trace Pb; calculated composition.
27	433	L	1940	78		No. 1	90.43	8.85	0.02		0.09	0.13		0.48 Co, 0.001 Sb, trace S, trace Pb; calculated composition.
28	433	L	1940	78		No. 2	85.62	13.71	0.017		0.094	0.10		0.46 Co, 0.002 Sb, 0.001 S, trace Pb; calculated composition.
29	433	L	1940	78		No. 3	77.73	21.69	0.015		0.091	0.05		0.414 Co, 0.003 Sb, 0.002 S, trace Pb; calculated composition.
30	433	L	1940	78		No. 4	69.14	30.35	0.014		0.068	0.05		0.37 Co, 0.005 Sb, 0.002 S, trace Pb; calculated composition.
31	433	L	1940	78		No. 5	58.98	40.53	0.012		0.104	0.04		0.314 Co, 0.006 Sb, 0.003 S, trace Pb; calculated composition.

DATA TABLE NO. 287 THERMAL CONDUCTIVITY OF [NICKEL + COPPER + ΣX_i] ALLOYS

(Ni + Cu < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
131.60	0.130
179.30	0.142
224.30	0.146
266.50	0.163
334.90	0.184
360.40	0.188
384.70	0.205
407.90	0.205
465.30	0.239
468.10	0.230
548.10	0.255
592.30	0.259
597.20	0.255
627.20	0.276
706.20	0.285
711.30	0.293
724.30	0.289
811.30	0.301
813.60	0.318
841.90	0.326
876.60	0.343
1011.00	0.368
1024.10	0.381
1185.70	0.410
CURVE 2	
4.20	0.00526
4.20	0.00533
14.00	0.0264
20.40	0.0412
63.30	0.137
73.70	0.138
77.90	0.125
77.00	0.141
77.30	0.146
77.30	0.153
CURVE 3	
2.55	0.00369
4.25	0.00911
14.00	0.0464
CURVE 3 (cont.)	
20.50	0.0745
54.00	0.140
63.00	0.144
63.70	0.147
58.40	0.164
77.00	0.168
CURVE 4	
2.60	0.00216
2.70	0.00218
4.20	0.0045
10.10	0.0131
20.40	0.0406
20.60	0.0428
51.60	0.0855
59.00	0.112
63.30	0.111
75.50	0.128
77.00	0.148
CURVE 5	
15.17	0.0444
18.16	0.0553
21.47	0.0661
31.80	0.0977
76.00	0.137
93.10	0.146
CURVE 6	
305.00	0.348
CURVE 7	
361.20	0.280
392.20	0.305
416.20	0.301
432.70	0.314
446.70	0.318
465.20	0.322
467.70	0.310
CURVE 7 (cont.)	
484.70	0.331
500.20	0.335
514.20	0.335
531.20	0.322
560.70	0.331
591.20	0.335
628.20	0.347
660.70	0.347
688.20	0.351
CURVE 8	
373.00	0.268
673.00	0.351
CURVE 9	
373.00	0.276
673.00	0.364
CURVE 10	
373.00	0.193
673.00	0.251
CURVE 11	
373.00	0.209
673.00	0.280
CURVE 12*	
373.00	0.197
673.00	0.251
CURVE 13*	
373.00	0.209
673.00	0.276
CURVE 14	
303.20	0.349
CURVE 15	
273.20	0.213
373.20	0.243
473.20	0.276
573.20	0.305
673.20	0.335
773.20	0.368
873.20	0.398
973.20	0.429
1073.20	0.460
CURVE 16	
273.20	0.213
473.20	0.289
CURVE 17	
336.70	0.259
473.20	0.272
673.20	0.310
873.20	0.352
1073.20	0.393
CURVE 18	
373.20	0.197
673.20	0.268
CURVE 19	
323.20	0.173
373.20	0.189
473.20	0.222
573.20	0.255
673.20	0.288
773.20	0.321
873.20	0.355
973.20	0.388
1073.20	0.422
1173.20	0.455
CURVE 20*	
373.20	0.268
673.20	0.352
CURVE 21	
323.20	0.260
CURVE 22	
323.20	0.188
CURVE 23	
323.20	0.268
CURVE 24	
25.43	0.0908
40.44	0.124
55.54	0.143
70.52	0.152
84.36	0.160
98.90	0.165
113.26	0.171
127.12	0.175
142.56	0.181
156.84	0.186
171.86	0.190
198.90	0.198
213.90	0.202
229.03	0.206
245.02	0.211
263.14	0.217
282.81	0.223
295.20	0.226
CURVE 25	
25.98	0.0565
40.92	0.0950
55.32	0.118
70.02	0.133
86.51	0.144
CURVE 25 (cont.)	
101.15	0.154
115.14	0.161
130.22	0.170
143.20	0.177
160.39	0.183
175.46	0.188
204.02	0.197
220.21	0.201
239.98	0.208
258.13	0.213
288.14	0.218
CURVE 26*	
78.2	0.464
CURVE 27*	
78.2	0.333
CURVE 28*	
78.2	0.269
CURVE 29*	
78.2	0.213
CURVE 30*	
78.2	0.182
CURVE 31*	
78.2	0.150

*Not shown on plot

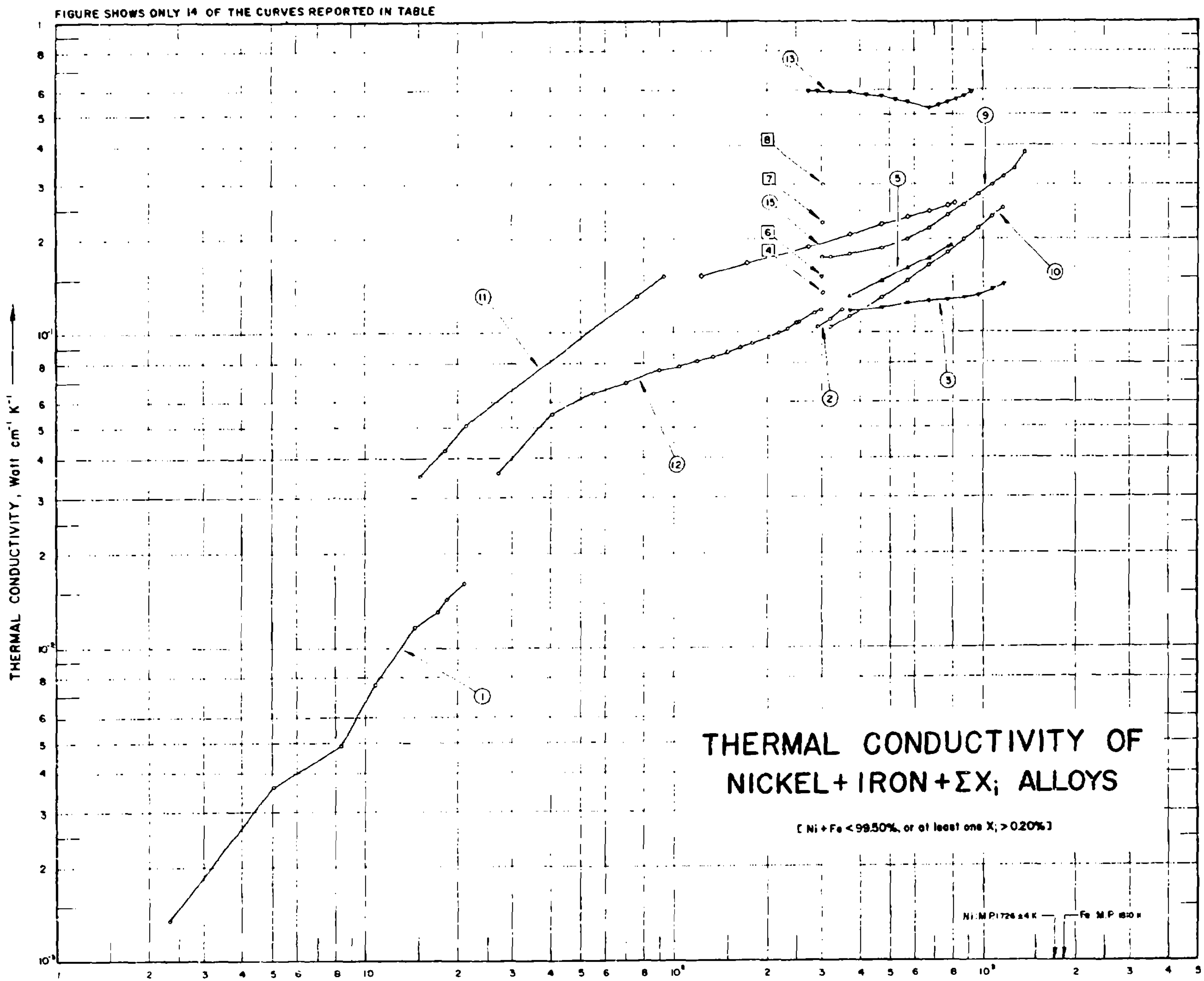


FIGURE SHOWS ONLY 14 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
NICKEL + IRON + ΣX; ALLOYS
[Ni + Fe < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ni: M.P. 1726 ± 4 K
Fe M.P. 1810 K

FIG 288

SPECIFICATION TABLE NO. 288 THERMAL CONDUCTIVITY OF [NICKEL + IRON + ΣX_i] ALLOYS

(Ni + Fe < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 288]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Fe	C	Co	Cr	Cu	Mn	Mo	Si	Composition (continued), Specifications and Remarks
							Composition (weight per cent)									
1	81	L	1939	2.3- 21		Contracid	60.0	16.0			15.0			7.0		
2	17	~~P~~ L	1958	293- 353	1.0	Contracid B7M	59.17	23.16			14.92		2.02	0.73	Trace	
3	168	L	1932	373-1173			61.0	20.0			15.0		4.0			
4	186	P	1928	305		Nichrome	62.0	26.0			12.0					
5	129	C	1933	373- 795	3.0-5.0	Chromel C	61.0	23.0			16.0					Hot-rolled.
6	178	E	1918	303		14a	55.4	41.14	0.208	0.142		2.61	0.331		0.133	0.012 P, 0.021 S; annealed at 900 C.
7	178	E	1918	303		15a	73.8	21.91	0.227	0.189		3.37	0.338		0.141	0.006 P, 0.019 S; annealed at 900 C.
8	178	E	1918	303		16a	83.0	12.27	0.266	0.213		3.75	0.341		0.144	0.003 P, 0.018 S; annealed at 900 C.
9	163	L	1936	303-1173		18	62.85	18.57	0.12		16.95		1.0		0.51	Rolled.
10	131	C	1953	323-1173	2.0	Hastelloy A	≈57.1	21.4	0.072				2.5	19.0		Annealed at 1150 C.
11	104	L	1951	15- 93		5277	57.5	40.71	0.34				1.31		0.14	As forged.
12	219	L	1951	28- 300	≤2.5	Contracid	60.05	15.82	0.05		14.74		2.14	7.20		Provided by G. E. Co.
13	73	P	1955	273-923			98.70	0.3	0.17			0.2	0.27			0.18 Mg, 0.04 S, 0.14 SiO_2; annealed.
14	218		1956	323			(min) 99.0	0.4	0.15			0.25	0.35		0.35	0.01 S; annealed.
15	937	L	1961	123-813		HyMu-80	79.24	15.283	0.049		0.08		0.71	4.20	0.19	Specimen 2.54 cm in dia and 37 cm long; packed in powder and annealed in hydrogen for 5 hrs at 922.1 K, 5 hrs at 1449.8 K, furnace cooled to 699.8 K, cooled in hydrogen; specimen, chemical composition and heat-treatment history provided by the International Nickel Co.; data presented as a smooth curve.

DATA TABLE NO. 288 THERMAL CONDUCTIVITY OF [NICKEL + IRON + ΣX_i] ALLOYS

(Ni + Fe < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
2.34	0.00135
5.07	0.00360
8.36	0.00489
10.70	0.00756
14.50	0.0116
17.26	0.0129
18.50	0.0142
21.00	0.0160

CURVE 2

T	k
293.20	0.105
323.20	0.112
353.20	0.120

CURVE 3

T	k
373.20	0.119
473.20	0.122
573.20	0.126
673.20	0.128
773.20	0.129
873.20	0.131
973.20	0.134
1073.20	0.139
1173.20	0.145

CURVE 4

T	k
305.00	0.136

CURVE 5

T	k
373.20	0.132
473.20	0.147
573.20	0.161
673.20	0.175
773.20	0.190
794.90	0.193

CURVE 6

T	k
303.20	0.151

CURVE 7

T	k
303.20	0.236

CURVE 8

T	k
303.20	0.304

CURVE 9

T	k
303.20	0.176
323.20	0.176
373.20	0.180
473.20	0.188
573.20	0.201
673.20	0.218
773.20	0.239
873.20	0.259
973.20	0.280
1073.20	0.301
1173.20	0.322
1273.20	0.343
1373.20	0.385

CURVE 10

T	k
323.20	0.105
373.20	0.114
473.20	0.131
573.20	0.148
673.20	0.166
773.20	0.183
873.20	0.201
973.20	0.218
1073.20	0.236
1173.20	0.253

CURVE 11

T	k
[illegible].12	0.351
18.20	0.0426
21.31	0.0510
76.40	0.132
92.90	0.153

CURVE 12

T	k
27.01	0.0360
40.28	0.0552
55.16	0.0644
69.86	0.0695
89.88	0.0766
104.93	0.0787
119.77	0.0820
134.83	0.0845
149.90	0.0874
154.97	0.0904
190.05	0.0933
204.13	0.0971
219.69	0.100
235.02	0.104
250.04	0.108
255.23	0.109
286.58	0.117
300.28	0.120

CURVE 13

T	k
273.20	0.597
293.20	0.597
323.20	0.596
373.20	0.592
423.20	0.584
473.20	0.576
523.20	0.563
573.20	0.549
673.20	0.528
723.20	0.537
773.20	0.549
823.20	0.564
873.20	0.578
923.20	0.593

CURVE 14*

T	k
323.20	0.606

CURVE 15

T	k
123.2	0.153

CURVE 15 (cont.)

T	k
173.2	0.167
273.2	0.189
373.2	0.208
473.2	0.222
573.2	0.234
673.2	0.245
773.2	0.255
813.2	0.260

*Not shown on plot

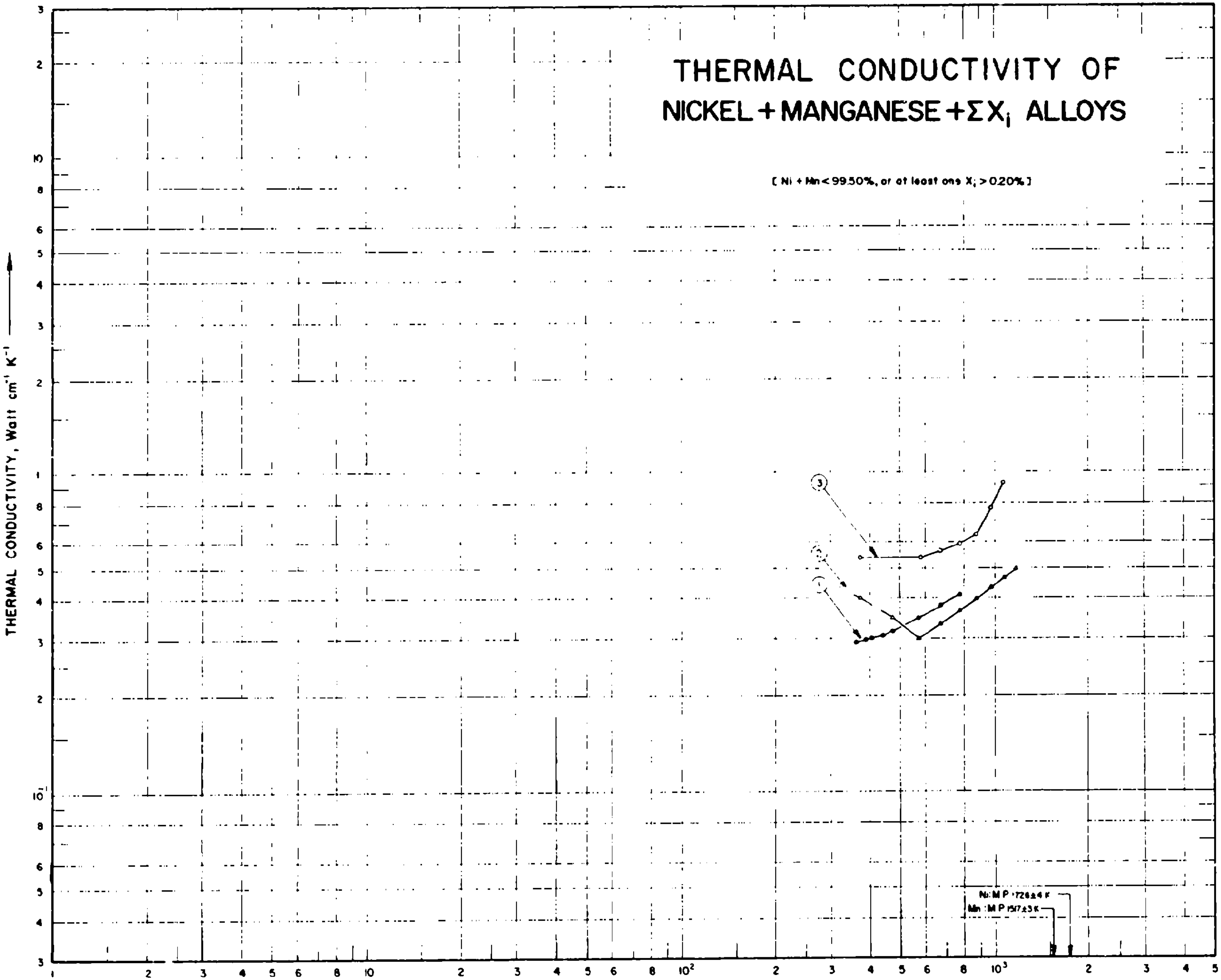

THERMAL CONDUCTIVITY OF
NICKEL + MANGANESE + ΣXi ALLOYS
[Ni + Mn < 99.50%, or at least one Xi > 0.20%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ni: M.P. 1726±4 K
Mn: M.P. 1517±3 K
1
2
3

FIG 289

SPECIFICATION TABLE NO. 289 THERMAL CONDUCTIVITY OF [*NICKEL + MANGANESE* + ΣX_i] ALLOYS

(Ni + Mn < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 289]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Mn	Al	C	Co	Cr	Fe	Si	*Composition (continued)*, Specifications and Remarks
							Composition (weight percent)								
1	129	C	1933	363-773	3.0-5.0	Alumel	94.943	2.0	2.0					1.0	Hot-rolled.
2	131	C	1953	323-1173	2.0	D Nickel	92.79	4.35		0.158	1.27		1.35	0.06	Annealed at 900 C.
3	439	L	1935	373-1073	2.0		97.5	1.9					0.4	0.14	
4	26	C	1954	423-910	6.0-19	Nickel A	99.542	0.25			0.034		0.068	0.03	0.034 Mg, 0.02 Ti, traces of Cu, Al, B, Ca, and Cr; cylindrical bar 2 cm in dia and ~15.5 cm long; Armco iron used as comparative material.

DATA TABLE NO. 289 THERMAL CONDUCTIVITY OF [NICKEL + MANGANESE + ΣX_i] ALLOYS

($Ni + Mn < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
363.40	0.293
389.20	0.397
405.10	0.301
441.30	0.307
473.20	0.318
573.20	0.350
673.20	0.381
773.20	0.412
CURVE 2	
323.20	0.430
373.20	0.403
473.20	0.350
573.20	0.300
673.20	0.334
773.20	0.367
873.20	0.399
973.20	0.431
1073.20	0.464
1173.20	0.497
CURVE 3	
373.2	0.540
583.2	0.540
673.2	0.565
773.2	0.594
873.2	0.636
973.2	0.778
1073.2	0.925
CURVE 4	
422.7	0.713
521.4	0.591
597.4	0.464
618.6	0.435
656.3	0.473
678.9	0.479
739.2	0.468
800.0	0.491
910.0	0.578

THERMAL CONDUCTIVITY OF NICKEL + MOLYBDENUM + ΣX; ALLOYS

[Ni + Mo < 99.50%, or at least one X_i > 0.20%]

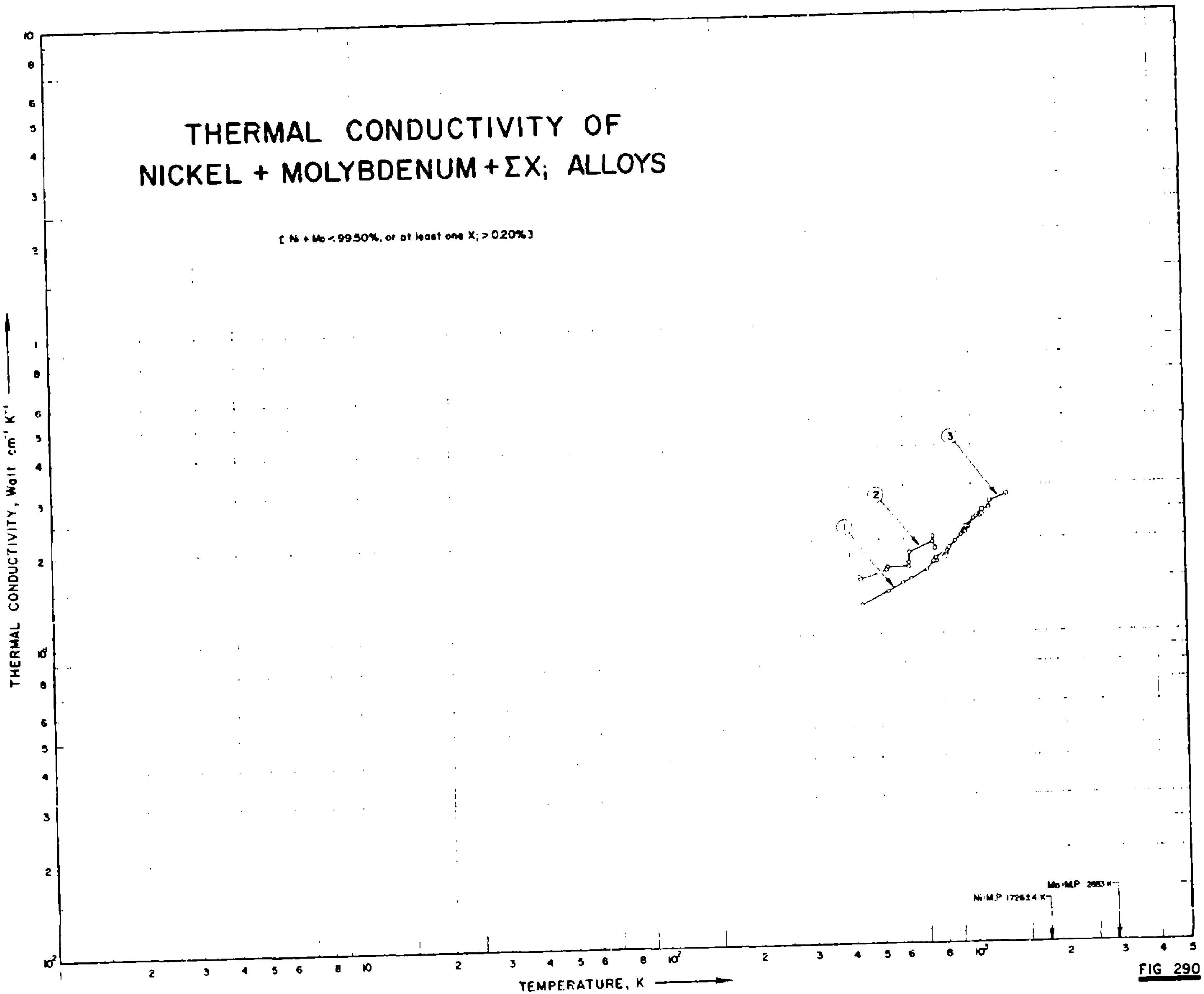


FIG 290

SPECIFICATION TABLE NO. 290 THERMAL CONDUCTIVITY OF [NICKEL + MOLYBDENUM + ΣX_i] ALLOYS

(Ni + Mo < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 290]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Mo	Cr	Fe	Mn	Si	Al	Composition (continued), Specifications and Remarks
1	568	R	1962	439-1090	± 3	INOR-8	71.1	16.2	7.25	4.6	0.36	0.34	0.22	0.17 W, 0.10 Ti, 0.084 C, 0.006 S, 0.003 P; specimen (composed of 18 disks, 9 in. long) 0.5 in. thick, 3 in. O.D. and 0.625 in. I.D.; prepared from a hot forged bar identified by Westinghouse as heat M1669-4.
2	569	C	1960	431-761	± 5	INOR-8	Bal.	17.0	7.0	5.0 Max	0.8 Max			0.06 C, 0.5 Max Al + Ti; nominal composition; specimen 6 in. long and 1 in. in dia; Armco iron used as comparative material.
3	43	L	1957	823-1319	± 5	Hastelloy B	65.57	23.78		5.05				0.02 C; specimen 6.75 in. in dia and 1.5 in. thick; "as received".

DATA TABLE NO. 290 THERMAL CONDUCTIVITY OF [NICKEL + MOLYBDENUM + ΣX_i] ALLOYS

(Ni + Mo < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
438.7	0.123
439.2	0.124*
535.7	0.136
537.7	0.137*
599.2	0.145
637.0	0.150
712.2	0.160
713.2	0.161*
759.9	0.171
769.0	0.172
769.0	0.173*
769.0	0.175
772.4	0.174*
842.4	0.188
843.2	0.187*
843.8	0.186*
882.2	0.196
883.2	0.195*
883.7	0.194*
923.8	0.205
924.0	0.204*
953.2	0.209
953.4	0.207*
954.0	0.206*
974.8	0.217
1013.2	0.231
1038.2	0.235
1039.6	0.235*
1075.2	0.236
1087.2	0.240
1088.2	0.239*
1089.7	0.240*
1090.2	0.241*
CURVE 2	
430.9	0.154
432.1	0.150
530.4	0.161
532.1	0.164
622.1	0.165
624.8	0.170
CURVE 2 (cont.)	
627.6	0.183
748.2	0.196
748.2	0.203
760.9	0.188
CURVE 3	
822.5	0.175
825.2	0.177
962.8	0.215*
962.9	0.217
1094.1	0.247
1148.4	0.253
1254.5	0.265
1319.2	0.279

*Not shown on plot

SPECIFICATION TABLE NO. 291 THERMAL CONDUCTIVITY OF [NICKEL + ΣX_i] ALLOYS Ni + ΣX_i

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Composition (continued), Specifications and Remarks
1	127	L	1923	372-1006			99.2	Specimen cast in 3 in. mold, hot-rolled to 1.5 in. dia, reheated and rolled to 0.875 in. dia, close-annealed at 800 C, cold drawn to 0.8125 in. dia, re-annealed and then drawn to 0.75 in. dia, and finally annealed at 750 C and 800 C; density 8.79 g cm^{-3} at 21 C.
2	34	L	1927	80, 273			>99	Electrical conductivity 90.2 and 13.05 x 10^4 ohm^{-1} cm^{-1} at 80 and 273 K, respectively.
3	40	L	1956	378-1616	5.0	Grade A		Grade "A" nickel; specimen 7 in. in dia and 1.5 in. thick; density 8.844 g cm^{-3}.
4	104	L	1951	15-93			99.4	As forged.
5	88	L	1908	113-301			99.0	
6	276	C	1953	343.2	3.0	Grade A		Grade "A" nickel (nominally 99.4 Ni + Co); density 8.8 g cm^{-3}; Armco iron used as comparative material.
7	163	L	1936	348-473		1	99.23	Data determined by using D. Hattori's method.
8	163	L	1936	588-1428		1		The above specimen using the method of K. Honda and T. Simidu; measured while increasing temp.
9	163	L	1936	468-1073		1		The above specimen; measured while reducing temp.
10	71	L	1917	299-1130			96.8	

DATA TABLE NO. 291 THERMAL CONDUCTIVITY OF [NICKEL + ΣX_i] ALLOYS Ni + ΣX_i

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1*

T	k
372.4	0.611
374.0	0.607
414.8	0.598
414.8	0.598
414.8	0.607
439.7	0.569
469.2	0.569
469.4	0.577
469.6	0.586
469.9	0.552
561.6	0.540
562.4	0.540
562.9	0.536
563.4	0.536
566.9	0.556
626.8	0.540
628.2	0.53[illegible]
630.4	0.536
630.5	0.536
764.2	0.531
764.6	0.540
976.5	0.590
1906.2	0.615

CURVE 2*

T	k
80	1.114
273	0.839

CURVE 3*

T	k
778	0.458
815	0.505
842	0.504
920	0.551
1088	0.583
1295	0.600
1386	0.651
1460	0.690
1616	0.719

CURVE 4*

T	k
15.12	0.180
18.15	0.221
21.50	0.274
77.10	0.610
93.10	0.661

CURVE 5*

T	k
113.2	0.540
123.2	0.543
148.2	0.552
173.2	0.560
198.2	0.569
223.2	0.573
248.2	0.582
273.2	0.586
291.2	0.586
301.2	0.577

CURVE 6*

T	k
343.2	0.636

CURVE 7*

T	k
348.2	0.782
378.2	0.732
433.2	0.678
473.2	0.653

CURVE 8*

T	k
388.2	0.753
483.2	0.653
563.2	0.569
571.2	0.565
603.2	0.519
633.2	0.494
663.2	0.469
683.2	0.481

CURVE 8 (cont.)*

T	k
693.2	0.477
803.2	0.515
943.2	0.567
1078	0.617
1178	0.661
1273	0.676
1293	0.682
1313	0.686
1338	0.690
1373	0.686
1428	0.690

CURVE 9*

T	k
468.2	0.653
698.2	0.494
863.2	0.527
1073	0.611

CURVE 10*

T	k
299.2	0.552
346.2	0.552
423.2	0.552
482.2	0.544
524.2	0.527
568.2	0.523
628.2	0.498
705.2	0.494
796.2	0.527
823.2	0.536
856.2	0.531
873.2	0.540
918.2	0.561
972.2	0.556
982.2	0.577
1041	0.577
1085	0.582
1130	0.530

* No graphical presentation

THERMAL CONDUCTIVITY OF NIOBIUM + MOLYBDENUM + ΣX_i ALLOYS

[Nb + Mo < 99.50%, or at least one X_i > 0.20%]

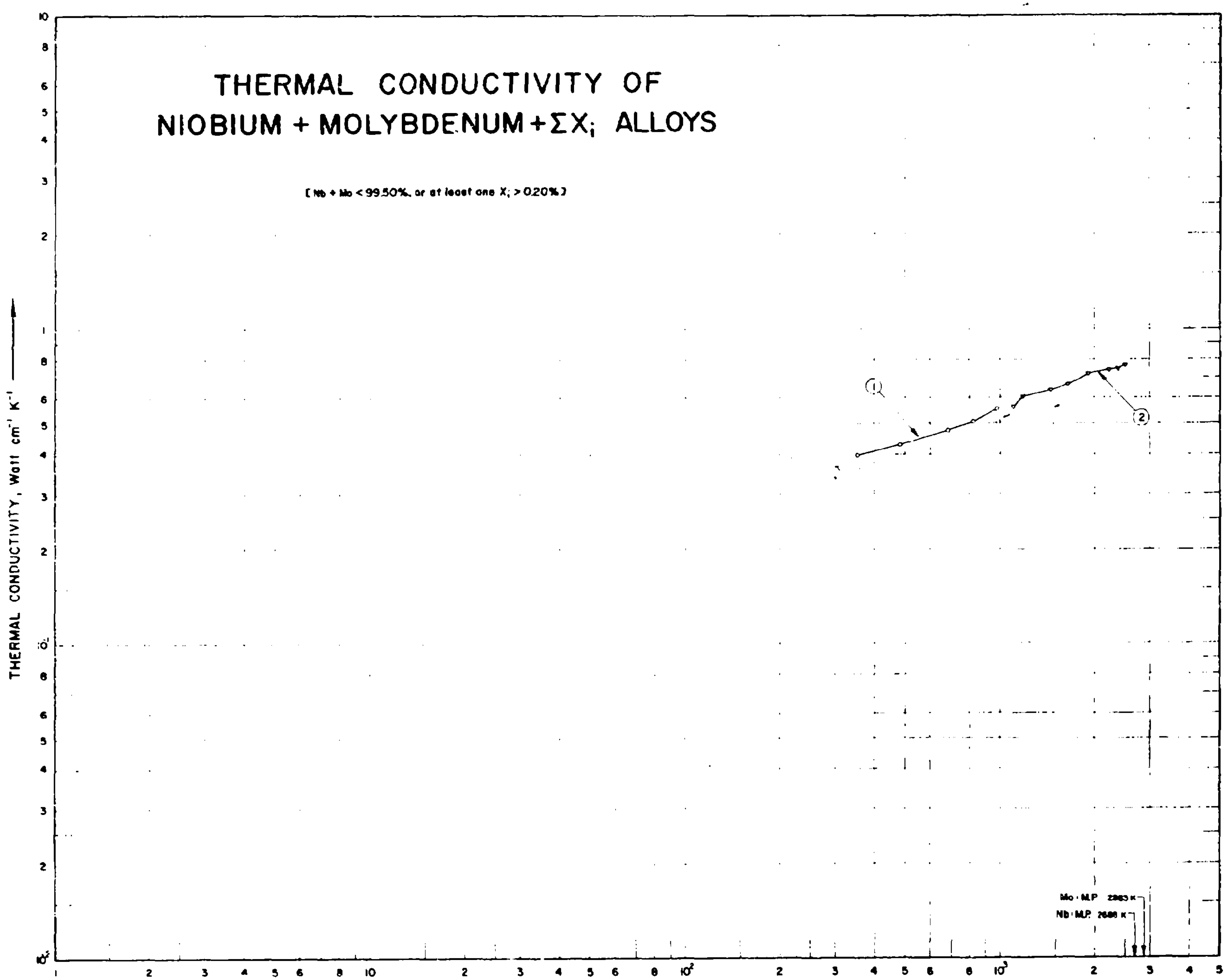


FIG 292

SPECIFICATION TABLE NO. 292 THERMAL CONDUCTIVITY OF [NIOBIUM + MOLYBDENUM + ΣX_i] ALLOYS

(Nb + Mo ≥ 99.5% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 292]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Nb	Mo	V	Zr	Composition (continued), Specifications and Remarks
1	583	C	1963	353-983	±4	Nb-5Mo-5V-1Zr	88.77	5.03	5.02	1.13	0.028 C, 0.0136 N, 0.0093 O; specimen 2 in. in dia and 1 in. long; density 8.62 g cm^{-3}; measured in helium atmosphere; Armco iron used as comparative material.
2	583	P	1963	1103-2508	±4	Nb-5Mo-5V-1Zr	88.77	5.03	5.02	1.13	0.028 C, 0.0136 N, 0.0093 O; the above specimen measured by another method; thermal conductivity values were calculated from the measurement of thermal diffusivity, specific heat and density.

DATA TABLE NO. 292 THERMAL CONDUCTIVITY OF [NIOBIUM + MOLYBDENUM + ΣX_i] ALLOYS

(Nb + Mo < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
352.6	0.398
483.2	0.431
688.7	0.476
822.1	0.504
983.1	0.550
CURVE 2	
1102.6	0.561
1193.2	0.604
1466.5	0.639
1660.9	0.665
1922.1	0.720
2230.4	0.739
2399.8	0.746
2508.2	0.765

THERMAL CONDUCTIVITY OF NIOBIUM + TANTALUM + ΣX_i ALLOYS

[Nb + Ta < 99.50%, or at least one X_i > 0.20%]

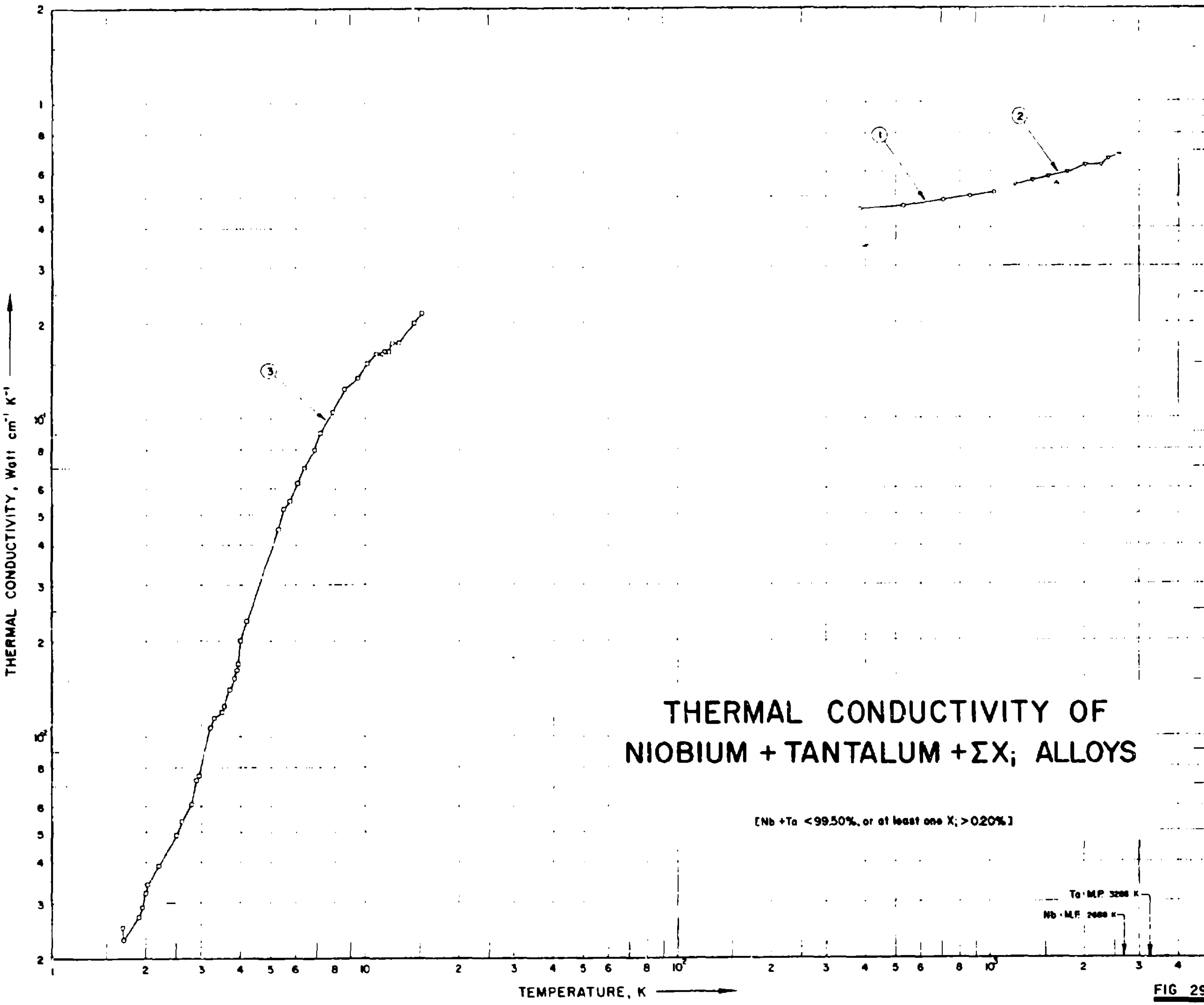


FIG 293

SPECIFICATION TABLE NO. 293 THERMAL CONDUCTIVITY OF [NIOBIUM + TANTALUM + ΣX_i] ALLOYS

(Nb + Ta < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 293]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Nb	Ta	W	Zr	Fe	Si	Composition (continued), Specifications and Remarks
1	583	C	1963	386-1044	±4	Nb-27Ta-12W-0.2Zr	60.8	27.84	10.40	0.92	0.007	0.01	0.009 Ni, 0.005 Ti, 0.005 O, 0.004 C, and 0.002 N; specimen 2 in. in dia and 1 in. long with ends ground flat and parallel; density 10.72 g cm^{-3}; measured in helium atmosphere; Armco iron used as comparative material.
2	583	P	1963	1208-2592	±4		60.8	27.84	10.40	0.92	0.007	0.01	The above specimen measured by another method.
3	704	L	1963	1.7-15	5		Bal.	1.0			0.03	0.02	0.005 Sn, 0.003 Pb, 0.0005 Cu, 0.0005 Ni, and 0.0001 Mg; specimen 10 cm long and 0.474 cm in dia; measured in "as received" condition; specimen from Johnson, Matthey and Co., Ltd.

DATA TABLE NO. 293 THERMAL CONDUCTIVITY OF [NIOBIUM + TANTALUM + ΣX_i] ALLOYS

(Nb + Ta < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k
CURVE 1		**CURVE 3 (cont.)**	
386.0	0.459	5.30	0.0450
530.4	0.467	5.50	0.0520
710.9	0.486	5.75	0.0550
869.3	0.502	6.10	0.0625
1044.3	0.517	6.40	0.0700
		6.90	0.0900
CURVE 2		7.20	0.0900
		7.90	0.105
1208.2	0.547	8.60	0.124
1379.3	0.566	9.50	0.134
1545.4	0.578	9.60	0.134*
1780.4	0.594	10.20	0.150
2027.6	0.630	10.25	0.149*
2227.6	0.630	10.95	0.162
2399.8	0.659	11.40	0.161
2591.5	0.675	11.60	0.164
		11.95	0.164
CURVE 3		12.20	0.174
		12.80	0.174
1.69	0.00250	14.40	0.199
1.70	0.00228	15.20	0.215
1.90	0.00270		
1.96	0.00290		
2.00	0.00320		
2.03	0.00340		
2.20	0.00390		
2.50	0.00490		
2.60	0.00540		
2.80	0.00610		
2.90	0.00730		
2.94	0.00750		
3.20	0.0107		
3.30	0.0115		
3.50	0.0120		
3.55	0.0125		
3.70	0.0140		
3.84	0.0153		
3.90	0.0163		
3.95	0.0170		
4.00	0.0200		
4.04	0.0201*		
4.20	0.0230		

*Not shown on plot

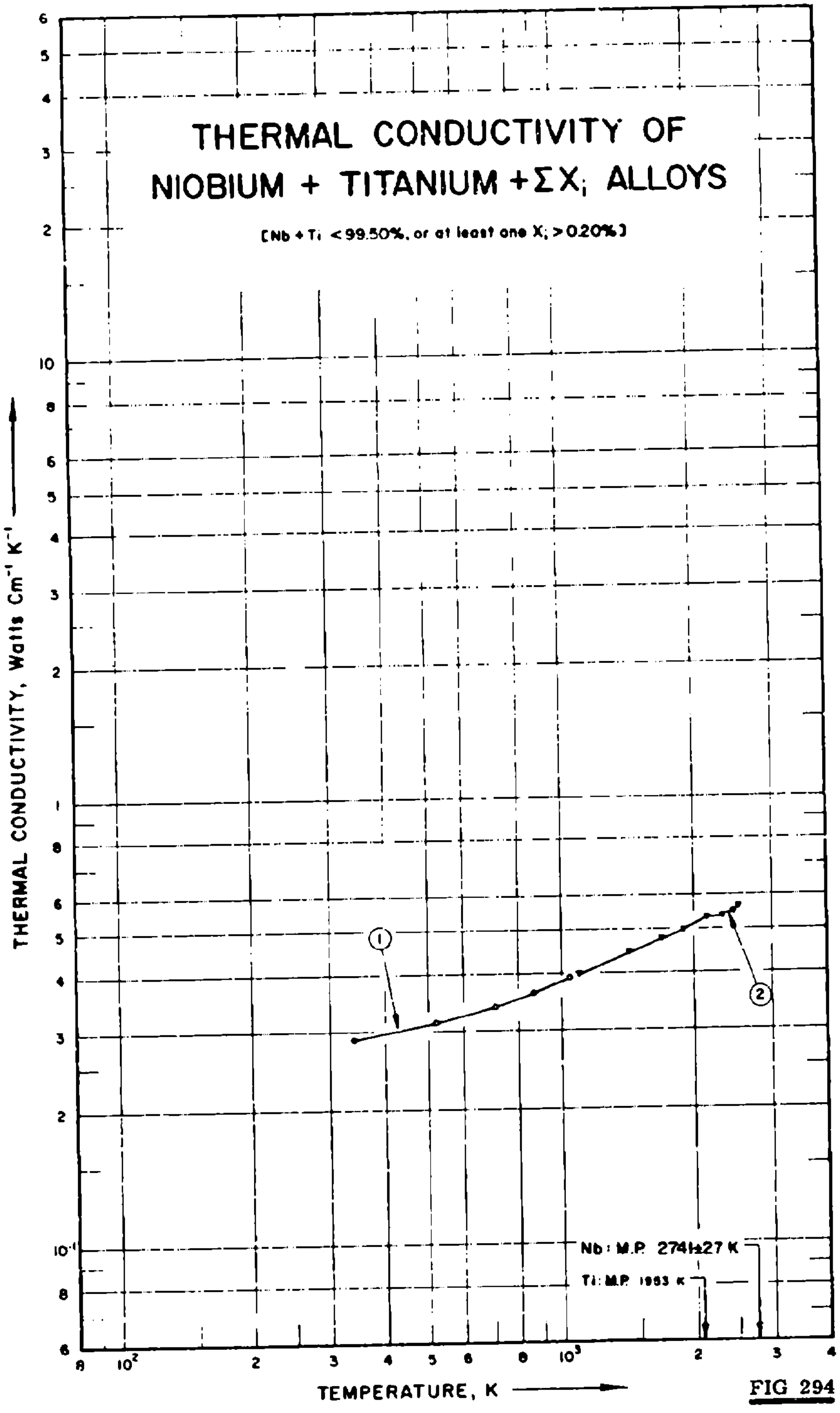

THERMAL CONDUCTIVITY OF
NIOBIUM + TITANIUM + ΣX_i ALLOYS
[Nb + Ti < 99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Nb: M.P. 2741±27 K
Ti: M.P. 1953 K
1
2

FIG 294

SPECIFICATION TABLE NO. 294 THERMAL CONDUCTIVITY OF [NIOBIUM + TITANIUM + ΣX_i] ALLOYS

($Nb + Ti < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 294]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Nb	Ti	Zr	Composition (continued), Specifications and Remarks
1	583	C	1963	342-1053	±4	Nb-10Ti-5Zr	83.96	10.5	5.5	0.0249 O, 0.0071 C, 0.0027 N and 0.0009 H; specimen 2 in. in dia and 1 in. long; density 7.77 g cm^{-3}; measured in helium atmosphere; Armco iron used as comparative material.
2	583	P	1963	1105-2544	±4	Nb-10Ti-5Zr	83.96	10.5	5.5	0.0249 O, 0.0071 C, 0.0027 N and 0.0009 H; the above specimen measured by another method; thermal conductivity values calculated from measurements of thermal diffusivity, specific heat and density.

DATA TABLE NO. 294 THERMAL CONDUCTIVITY OF [NIOBIUM + TITANIUM + ΣX_i] ALLOYS

($Nb + Ti < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
341.5	0.287
523.2	0.312
712.6	0.339
872.1	0.362
1053.2	0.393
CURVE 2	
1105.4	0.398
1447.1	0.443
1702.6	0.471
1916.5	0.498
2163.7	0.530
2349.6	0.533
2483.2	0.547
2544.3	0.561

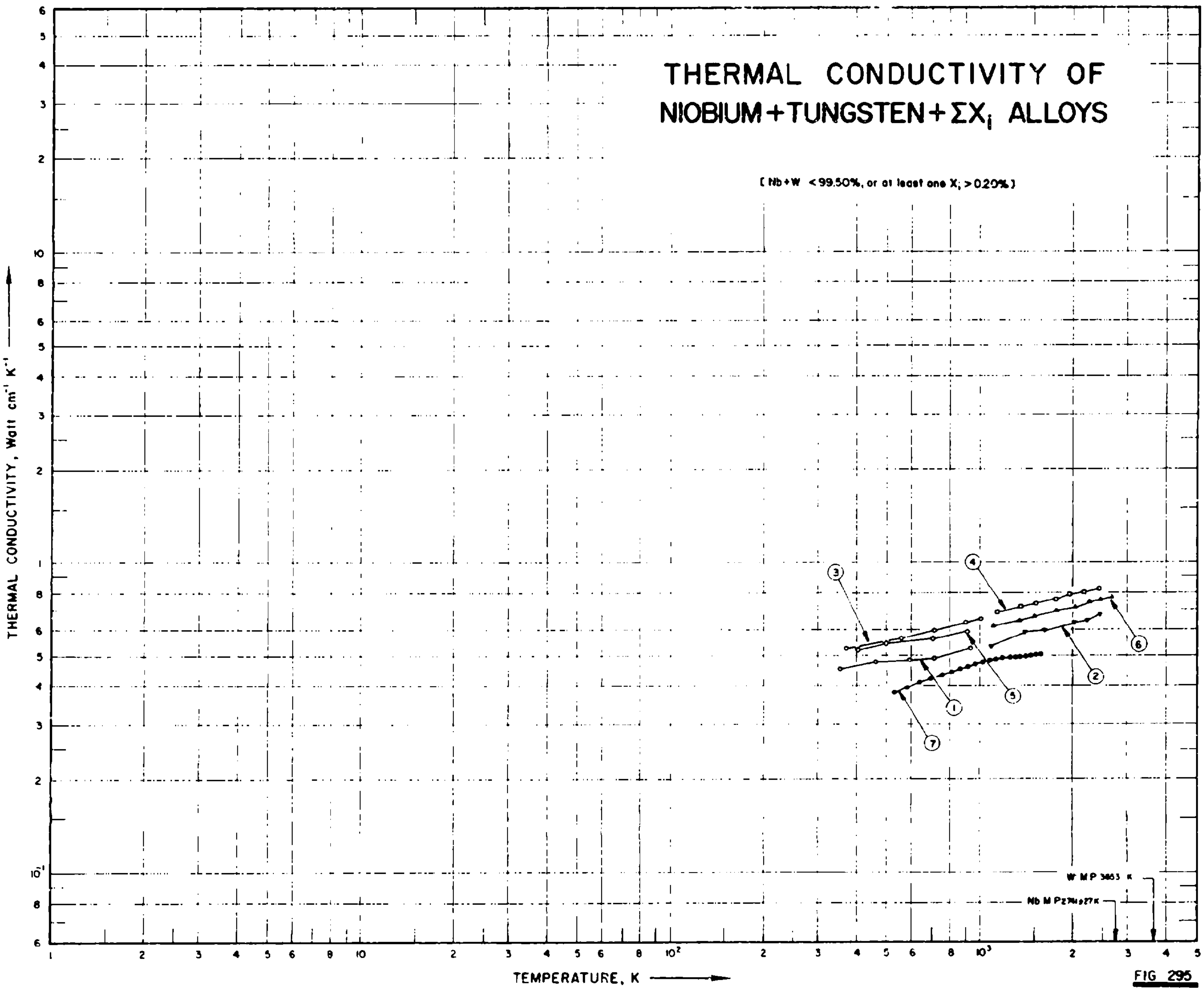

THERMAL CONDUCTIVITY OF
NIOBIUM + TUNGSTEN + ΣX_i ALLOYS
[Nb+W < 99.50%, or at least one X_i > 0.20%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
W M P 3653 K
Nb M P 2741±27 K
1
2
3
4
5
6
7

FIG 295

SPECIFICATION TABLE NO. 295 THERMAL CONDUCTIVITY OF [NIOBIUM + TUNGSTEN + ΣX_i] ALLOYS

(Nb + W < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 295]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Nb	W	Zr	Mo	Composition (continued), Specifications and Remarks
1	583	C	1963	355-939	±4	Nb-10W-5Zr	87.3	9.88	2.8		0.008 O, 0.004 N, 0.002 C and 0.0011 H; specimen 2 in. in dia and 1 in. long; density 9.16 g cm^{-3}; measured in helium atmosphere; Armco iron used as comparative material.
2	583	P	1963	1098-2461	±4	Nb-10W-5Zr	87.3	9.88	2.8		0.008 O, 0.004 N, 0.002 C and 0.0011 H; the above specimen measured by another method; thermal conductivity values were calculated from the measurement of thermal diffusivity, specific heat and density.
3	583	C	1963	372-1011	±4	Nb-10W-1Zr-0.1C	89.39	9.6	0.95		0.051 C, 0.0053 O, 0.0033 N and 0.0003 H; specimen 2 in. in dia and 1 in. long; density 9.03 g cm^{-3}; measured in helium atmosphere; Armco iron used as comparative material.
4	583	P	1963	1150-2455	±4	Nb-10W-1Zr-0.1C	89.39	9.6	0.95		0.051 C, 0.0053 O, 0.0033 N and 0.0003 H; the above specimen measured by another method; thermal conductivity values were calculated from the measurement of thermal diffusivity, specific heat and density.
5	583	C	1963	405-915	±4	Nb-15W-5Mo-1Zr-0.05C	78.78	15.6	0.84	4.7	0.01 Ta, 0.0489 C, 0.0163 O, 0.002 N and 0.0005 H; specimen 2 in. in dia and 1 in. long; density 9.6 g cm^{-3}; measured in helium atmosphere; Armco iron used as comparative material.
6	583	P	1963	1117-2678	±4	Nb-15W-5Mo-1Zr-0.05C	78.78	15.6	0.84	4.70	0.01 Ta, 0.0489 C, 0.0163 O, 0.002 N and 0.0005 H; the above specimen measured by another method; thermal conductivity values were calculated from the measurement of thermal diffusivity, specific heat and density.
7	968		1963	533-1589	±10	Haynes alloy Nb-752	87.5	10	2.5		No details reported.

DATA TABLE NO. 295 THERMAL CONDUCTIVITY OF [NIOBIUM + TUNGSTEN + ΣX_i] ALLOYS

(Nb + W < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		CURVE 6 (cont.)	
355.4	0.453	1516.5	0.668
462.7	0.478	1788.2	0.692
594.3	0.486	2044.3	0.717
719.3	0.490	2283.2	0.742
938.7	0.528	2483.2	0.758
		2677.6	0.775
CURVE 2			
		CURVE 7	
1097.6	0.533		
1406.5	0.588	533.2	0.381
1643.2	0.599	588.7	0.398
2027.6	0.633	644.3	0.412
2244.3	0.640	699.8	0.424
2461.0	0.675	755.4	0.436
		810.9	0.447
CURVE 3		866.5	0.457
		922.1	0.464
372.1	0.528	977.6	0.471
560.9	0.566	1033.2	0.478
716.5	0.597	1088.7	0.485
905.4	0.632	1144.3	0.190
1010.9	0.652	1199.8	0.493
		1255.4	0.495
CURVE 4		1310.9	0.497
		1366.5	0.498
1149.8	0.689	1422.1	0.500
1365.4	0.715	1477.6	0.502
1522.1	0.736	1533.2	0.504
1766.5	0.751	1588.7	0.505
1960.9	0.787		
2183.2	0.800		
2455.4	0.824		
CURVE 5			
405.4	0.521		
499.8	0.549		
708.2	0.564		
914.8	0.590		
CURVE 6			
1116.5	0.620		
1352.6	0.644		

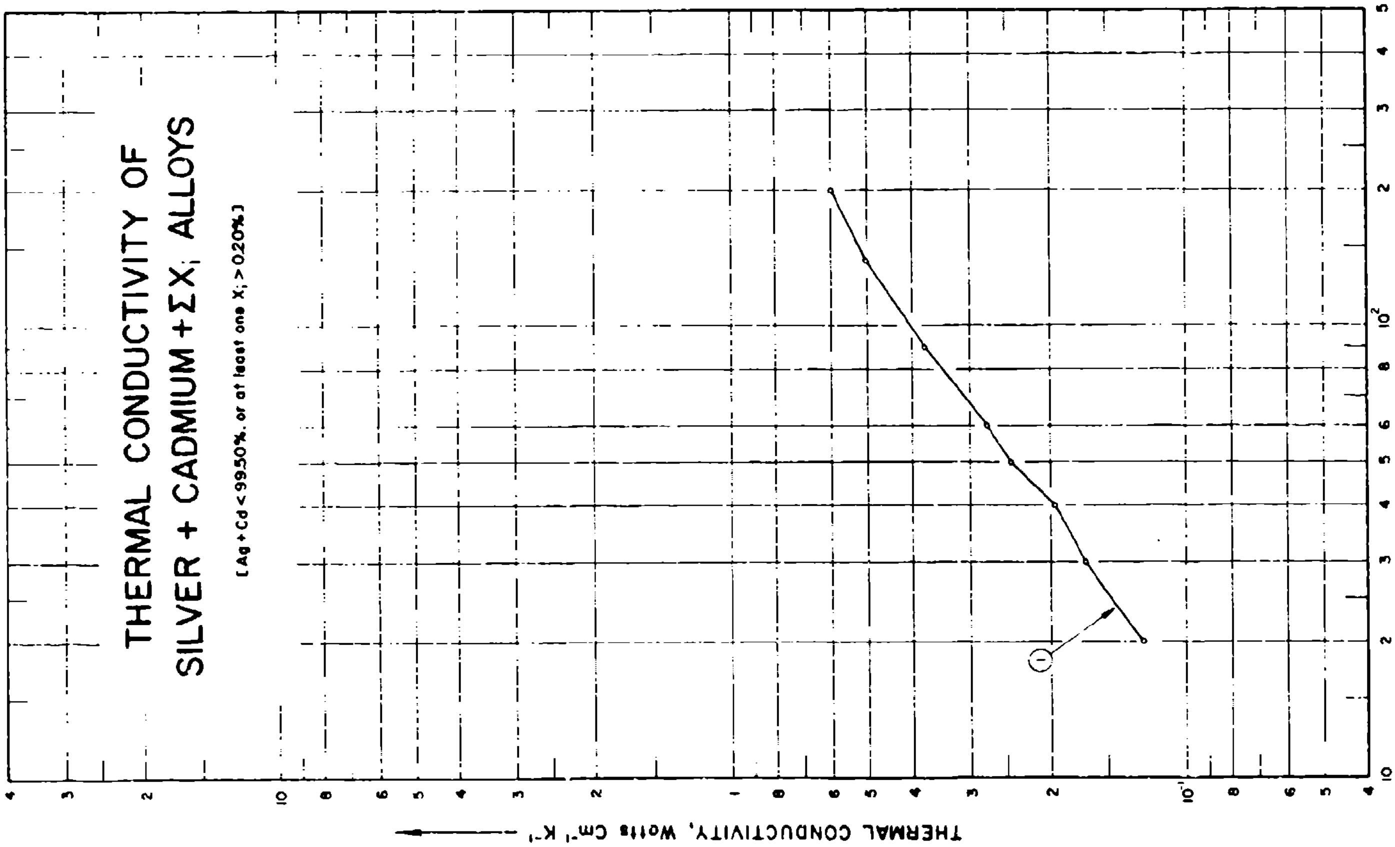

THERMAL CONDUCTIVITY OF
SILVER + CADMIUM + ΣX_i ALLOYS
[Ag + Cd < 99.50%, or at least one X_i > 0.20%]
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm^-1 K^-1

FIG 296

SPECIFICATION TABLE NO. 296 THERMAL CONDUCTIVITY OF [SILVER + CADMIUM + ΣX_i] ALLOYS

($Ag + Cd \leq 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 296]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Cd	Cu	Zn	Composition (continued), Specifications and Remarks
1	584	L	1953	20-200	5.0	Easy-Flo Silver solder	50.0	18.0	15.5	16.5	Drawn and annealed.

DATA TABLE NO. 296 THERMAL CONDUCTIVITY OF [SILVER + CADMIUM + ΣX_i] ALLOYS

($Ag + Cd < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
20	0.126
30	0.167
40	0.196
50	0.243
60	0.275
90	0.376
140	0.503
200	0.600

SPECIFICATION TABLE NO. 297 THERMAL CONDUCTIVITY OF [SILVER + ΣX_i] ALLOYS $Ag + \Sigma X_i$

Curv No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ag	Composition (continued), Specifications and Remarks
1	37	C	1951	310-810	4.0		99.4	National Bureau of Standards' melting-point standard lead used as comparative material.

DATA TABLE NO. 297 THERMAL CONDUCTIVITY OF [SILVER + ΣX_i] ALLOYS $Ag + \Sigma X_i$

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
310	4.195
367	4.170
422	4.075
478	3.986
533	3.900
588	3.805
644	3.720
700	3.630
755	3.540
810	3.453

* No graphical presentation

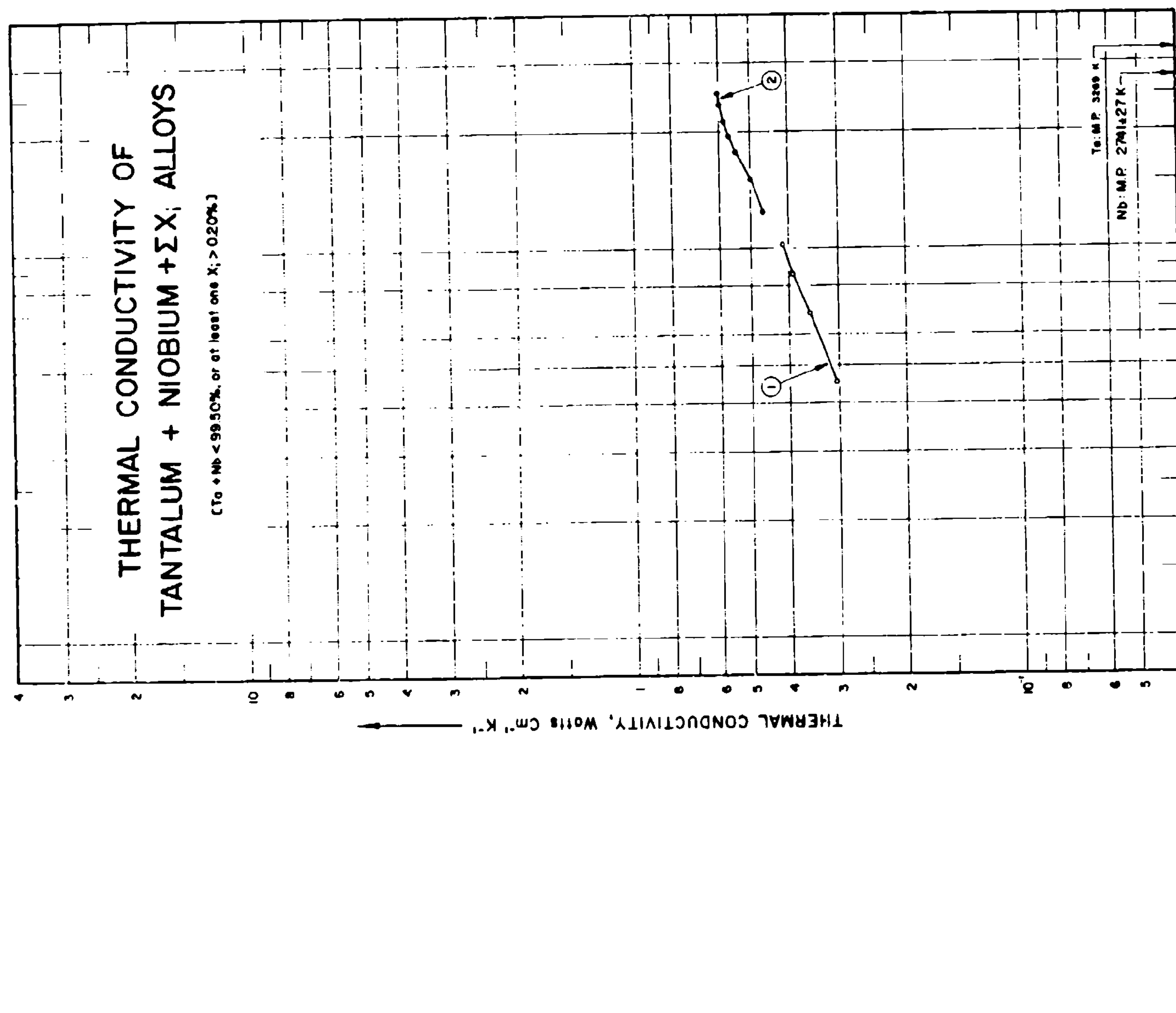

THERMAL CONDUCTIVITY OF
TANTALUM + NIOBIUM + ΣX_i ALLOYS
($Ta + Nb < 99.50\%$, or at least one $X_i > 0.20\%$)
Ta: M.P. 3269 K
Nb: M.P. 2741±27K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}
1
2

FIG 298

SPECIFICATION TABLE NO. 298 THERMAL CONDUCTIVITY OF [TANTALUM + NIOBIUM + ΣX_i] ALLOYS

(Ta + Nb < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 298]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ta	Nb	V	C	Composition (continued), Specifications and Remarks
1	583	C	1963	454-1031	±4	Ta-30Nb-7.5V	62.12	30.3	7.47	0.09	0.015 O, 0.0065 N; specimen 2 in. in dia and 1 in. long; density 11.55 g cm^{-3}; measured in helium atmosphere; Armco iron used as comparative material.
2	583	P	1963	1246-2511	±4	Ta-30Nb-7.5V	62.12	30.3	7.47	0.09	0.015 O, 0.0065 N; the above specimen measured by another method; thermal conductivity values were calculated from the measurement of thermal diffusivity, specific heat and density.

DATA TABLE NO. 298 THERMAL CONDUCTIVITY OF [TANTALUM + NIOBIUM + ΣX_i] ALLOYS

(Ta + Nb < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
454.3	0.305
688.7	0.353
860.9	0.391
1039.9	0.415
CURVE 2	
1245.9	0.467
1508.2	0.497
1772.1	0.545
1958.2	0.569
2133.7	0.583
2352.6	0.598
2511.0	0.604

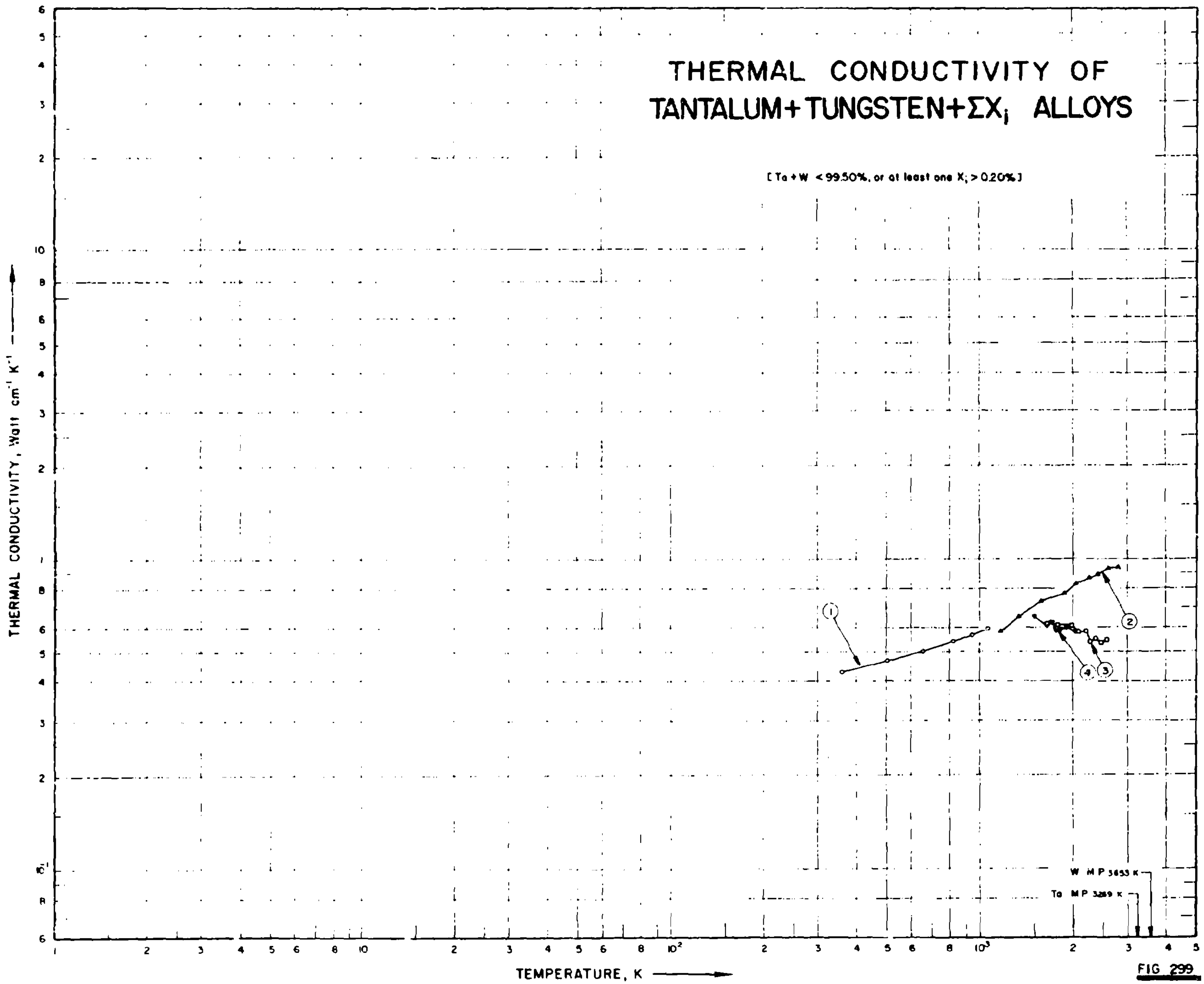

THERMAL CONDUCTIVITY OF
TANTALUM+TUNGSTEN+ΣX$_i$ ALLOYS
[Ta+W < 99.50%, or at least one X$_i$ > 0.20%]
W M P 3653 K
Ta M P 3269 K
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K

FIG 299

SPECIFICATION TABLE NO. 299 THERMAL CONDUCTIVITY OF [TANTALUM + TUNGSTEN + ΣX_i] ALLOYS

($Ta + W < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 299]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ta	W	Hf	Composition (continued), Specifications and Remarks
1	583	C	1963	361-1072	± 4.0	Ta-8W-2Hf	88.79	9.0	2.2	0.0041 C, 0.0040 O, 0.0023 N; specimen 2 in. in dia and 1 in. in length; end-ground flat and parallel; density 16.95 g cm^{-3}; measured in helium atmosphere; Armco iron used as comparative material.
2	583	P	1963	1172-2803	± 4.0	Ta-8W-2Hf	88.79	9.0	2.2	The above specimen measured by another method.
3	849	-	1966	1660-2599		T_{222}; No. 1	Bal	8.5	2.5	0.0095 C, 0.0012 H and 0.0006 O impurities; specimen 2.2524 cm in dia and 0.332 cm long; heated in high vacuum (10^{-5} mm Hg) by high frequency induction to 1000-3000 C; localized heating within 0.003 in. of the surface at current frequency of 500000 cps, heat lost only by radiation, the cylindrical surface being assumed isothermal, and the temperature gradient along the radius was analytically correlated to the thermal conductivity; density 16.81 g cm^{-3}.
4	849	-	1966	1509-2111		T_{222}; No. 2	88.9887	8.5	2.5	0.0095 C, 0.0012 H and 0.0006 O impurities; similar to the above specimen.

DATA TABLE NO. 299 THERMAL CONDUCTIVITY OF [TANTALUM + TUNGSTEN + ΣX_i] ALLOYS

(Ta + W < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
361.0	0.433
505.4	0.469
660.9	0.502
822.1	0.542
949.8	0.569
1072.1	0.597
CURVE 2	
1172.1	0.588
1346.5	0.654
1580.4	0.732
1888.7	0.772
2063.7	0.832
2263.7	0.867
2427.5	0.890
2608.2	0.933
2802.6	0.938
CURVE 3	
1660	0.618
1798	0.613
1990.5	0.611
2110.5	0.580
2231	0.594
2291.5	0.540
2390	0.553
2486.5	0.536
2598.5	0.545
CURVE 4	
1509	0.650
1662	0.609
1716	0.621
1784	0.585
1842	0.591
1925	0.596
1933	0.597*
20[illegible]2	0.581
2111	0.594*

*Not shown on plot

SPECIFICATION TABLE NO. 300 THERMAL CONDUCTIVITY OF [TELLURIUM + ARSENIC + ΣX_i] ALLOYS $Te + As + \Sigma X_i$

($Te + As < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Te	As	Se	Composition (continued), Specifications and Remarks
1	1006	L	1963	313.2		5	40	30	30	52 mm dia x 2.5 mm thick; obtained from Servo Corp. of America; ground and polished; electrical resistivity 2.5 x 10^6 ohm cm at room temperature.
2	1006	L	1963	313.2		8	40	40	20	Similar to the above specimen except electrical resistivity 2.0 x 10^6 ohm cm at room temperature.

DATA TABLE NO. 300 THERMAL CONDUCTIVITY OF [TELLURIUM + ARSENIC + ΣX_i] ALLOYS $Te + As + \Sigma X_i$

($Te + As < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
313.2	0.00227
CURVE 2*	
313.2	0.00220

* No graphical presentation

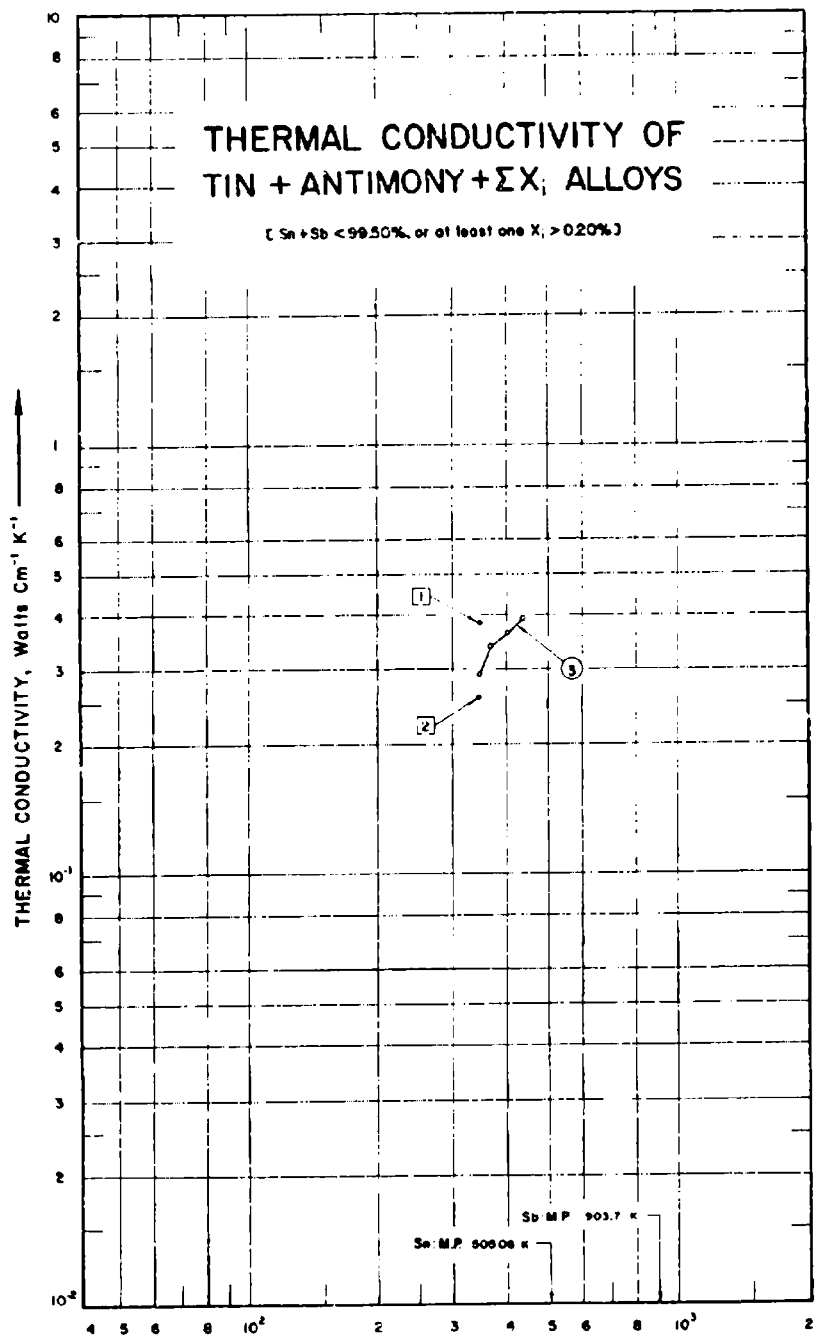

THERMAL CONDUCTIVITY OF
TIN + ANTIMONY + ΣX; ALLOYS
[Sn + Sb < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Sb: M.P. 903.7 K
Sn: M.P. 505.08 K
1
2
3

FIG 301

SPECIFICATION TABLE NO. 301 THERMAL CONDUCTIVITY OF [TIN + ANTIMONY + ΣX_i] ALLOYS

($Sn + Sb > 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 301]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Sb	Cu	Pb	Composition (continued), Specifications and Remarks
1	224	L	1923	348.2		SAE Bearing Alloy no. 10	92.49	3.74	3.58	0.19	
2	224	L	1923	348.2		SAE Bearing Alloy no. 11	86.92	7.90	5.16	0.12	
3	30	L	1925	350-441	< 2.0	White B.M.	87.8	7.73	4.0	0.12	0.14 Fe; specimen machined from a dry sand cast bar, (this alloy referred to as "white bearing metal).

DATA TABLE NO. 301 THERMAL CONDUCTIVITY OF [TIN + ANTIMONY + ΣX_i] ALLOYS

[Sn + Sb < 99.50% or at least one X_i > 0.20%]

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
348.2	0.385
CURVE 2	
348.2	0.259
CURVE 3	
349.7	0.293
370.7	0.339
402.7	0.364
440.7	0.393

SPECIFICATION TABLE NO. 302 THERMAL CONDUCTIVITY OF [TIN + COPPER + ΣX_i] ALLOYS $Sn + Cu + \Sigma X_i$

($Sn + Cu < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sn	Cu	Ni	Composition (continued), Specifications and Remarks
1	215	L	1939	373, 673	±2.0		51.39	37.86	9.91	0.86 Zn; cast.

DATA TABLE NO. 302 THERMAL CONDUCTIVITY OF [TIN + COPPER + ΣX_i] ALLOYS $Sn + Cu + \Sigma X_i$

($Sn + Cu < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
373.2	0.209
673.2	0.276

*No graphical presentation

FIGURE SHOWS ONLY 9 OF THE CURVES REPORTED IN TABLE

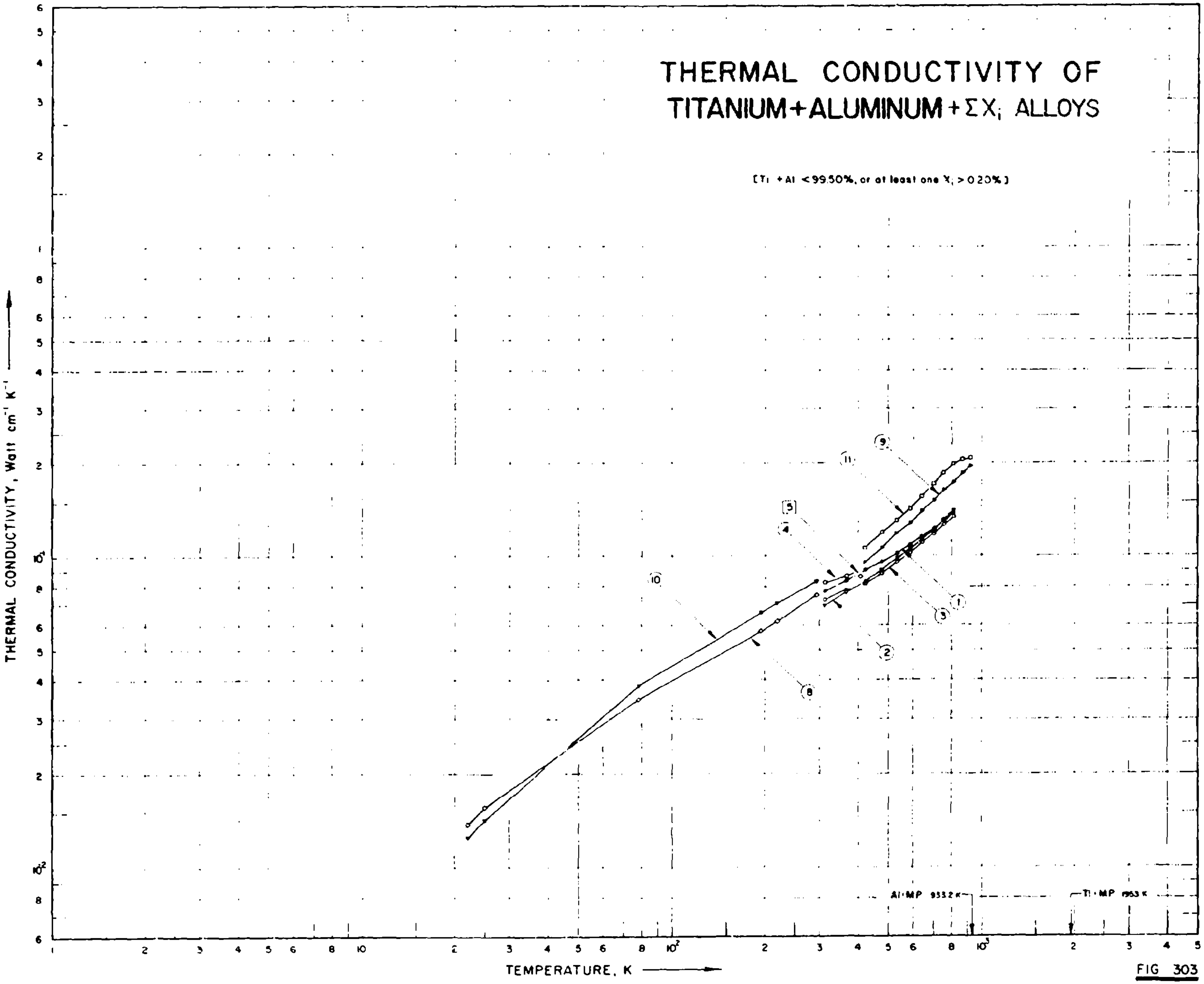


FIG 303

SPECIFICATION TABLE NO. 303 THERMAL CONDUCTIVITY OF [TITANIUM + ALUMINUM + ΣX_i] ALLOYS

(Ti + Al < 99.50% or at least one X_i > 0.20%)

[For Data Reported in Figure and Table No. 303]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ti	Al	V	Cr	Fe	Mo	Sn	Mn	Composition (continued), Specifications and Remarks
1	231	C	1958	311-811	< 5	A-110 AT	Bal.	5.0					2.5		Nominal composition; specimen in mill-annealed condition; lead used as comparative material.
2	231	C	1958	311-811	< 5	C-130 AM	Bal.	4.0						4.0	Nominal composition; formerly designated as RC-130B; in mill-annealed condition.
3	231	C	1958	311-811	< 5	Ti-6Al-4V	Bal.	6.0	4.0						Nominal composition; in mill-annealed condition.
4	231	C	1958	311-811	< 5	Ti-155A	Bal.	5.0		1.4	1.5	1.2			Nominal composition; in mill-annealed condition.
5	555		1956	408.2			Bal.	7.0							0.5 Si.
6	831	L	1963	23-299	±5	6Al-4V	Bal.	5.89	3.87		0.15				0.02 C, [illegible] N, 0.005 H; the alloy produced by [illegible]-Sharon Metals Corp. [illegible] treated at 1199.8 K for 20 min [illegible] quenched, aged at 755 K for 4 [illegible] and air cooled; measured under vacuum (< 10^{-6} mm Hg).
7	831	L	1963	25-300	±5	4Al-3Mo-1V	Bal.	4.4	1.0		0.10	3.0			0.03 C, 0.011 N, 0.0057 H; the alloy produced by Crucible Steel Co.; heat-treated at 1175 K, aged at 769 K for 12 hrs and measured under vacuum (< 10^{-6} mm Hg).
8	939	L	1962	22-294		6Al-4V	Bal.	5.89	3.87		0.15				0.2 C, 0.015 N; specimen 4 in. x 0.375 in. x 0.125 in.; supplied by Reactive Metals, Inc.; solution heat-treated at 1200 K for 20 min and aged at 755 K for 4 hrs; density 4.4 g cm^{-3}
9	939	L	1962	422-922		6Al-4V	Bal.	5.89	3.87		0.15				0.2 C, 0.015 N; specimen 10 in. x 0.5 in x 0.125 in.; supplied by Reactive Metals Inc., Niles, Ohio; solution heat-treated at 1200 K for 20 min and aged at 755 K for 4 hrs; density 4.4 g cm^{-3}.
10	939	L	1962	22-294		4Al-3Mo-1V	Bal.	1.0			0.10	3.0			0.03 C, 0.011 N; specimen 4 in. x 0.125 in.; supplied by Crucible Steel Co. of America, Pittsburg, Penn.; solution heat-treated at 1175 K for 15~30 min and aged at 769 K for 12 hrs; density 4.51 g cm^{-3}.

SPECIFICATION TABLE NO. 303 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ti	Al	V	Cr	Fe	Mo	Sn	Mn	Composition (continued), Specifications and Remarks
11	939	L	1962	422-922		4Al-3Mo-1V	Bal.	4.4	1.0		0.10	3.0			0.03 C, 0.011 N; specimen 10 in. x 0.5 in. x 0.125 in.; supplied by Crucible Steel Co. of America, Pittsburg, Penn.; solution heat-treated at 1175 K for 15-30 min and aged at 769 K for 12 hrs; density 4.51 g cm^{-3}.

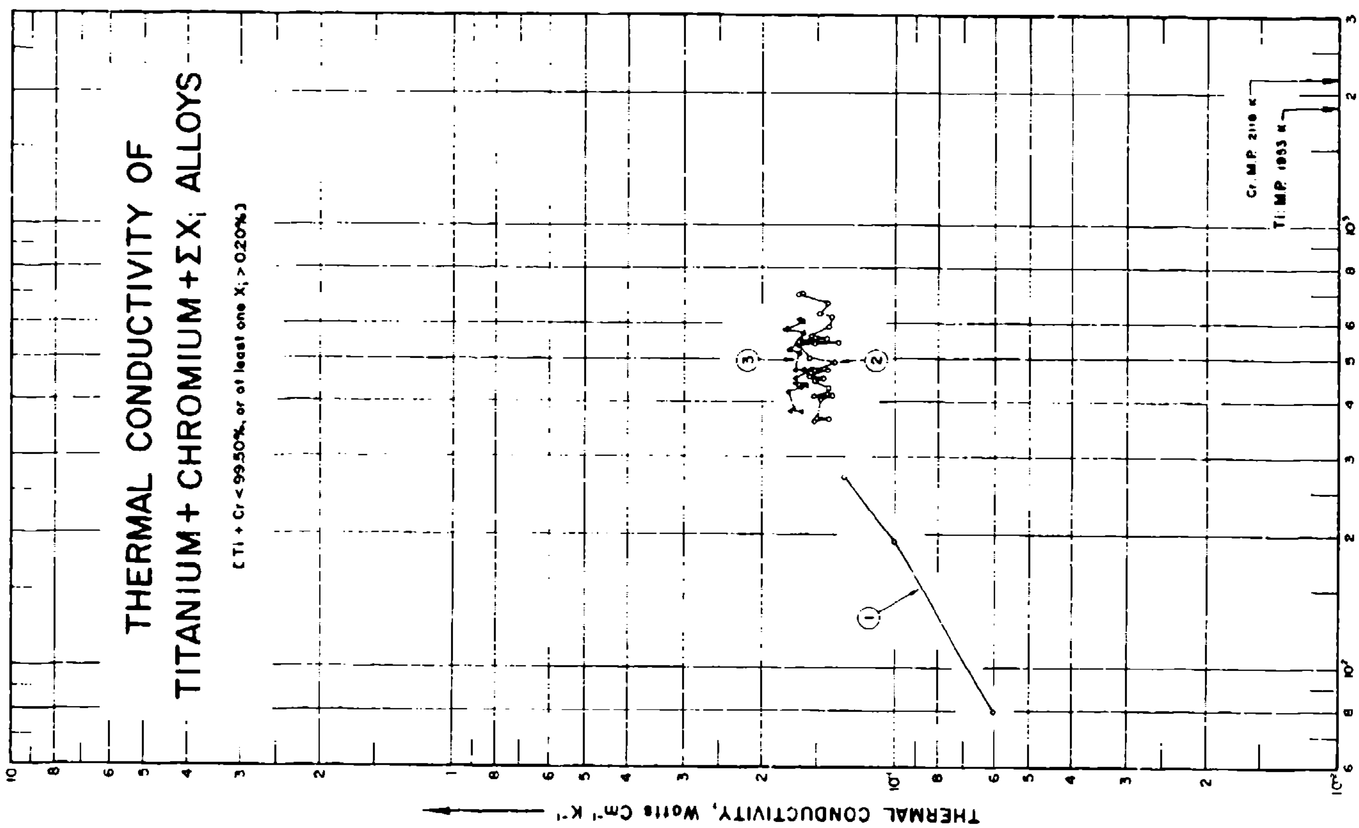
DATA TABLE NO. 303 THERMAL CONDUCTIVITY OF [TITANIUM + ALUMINUM + ΣX_i] ALLOYS

(Ti + Al < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k	T	k	T	k
CURVE 1		CURVE 4 (cont.)		CURVE 7 (cont.)*		CURVE 11 (cont.)	
311.00	0.0782	477.00	0.0958*	224.67	0.0720	644	0.156
366.00	0.0837	533.00	0.101*	283.09	0.0814	700	0.170
422.00	0.0900	589.00	0.107*	300.45	0.0843	755	0.185
477.00	0.0958	644.00	0.113*	300.45	0.0846	811	0.197
533.00	0.1021	700.00	0.120*			867	0.204
589.00	0.1088	755.00	0.128*	CURVE 8		922	0.206
644.00	0.11[illegible]	811.00	0.138*				
700.00	0.12[illegible]			22	0.0137		
755.00	0.130	CURVE 5		25	0.0156		
811.00	0.138			78	0.0348		
		408.2	0.0862	194	0.0575		
CURVE 2				219	0.0618		
		CURVE 6*		294	0.0751		
311.00	0.0698						
366.00	0.0770	23.39	0.0146	CURVE 9			
422.00	0.0837	24.17	0.0156				
477.00	0.0908	24.64	0.0154	422	0.095		
533.00	0.0987	24.64	0.0155	478	0.106		
589.00	0.1058	25.40	0.0160	533	0.118		
644.00	0.114	25.42	0.0160	589	0.128		
700.00	0.122	81.90	0.0358	644	0.140		
755.00	0.131	81.90	0.0359	700	0.151		
811.00	0.140	82.06	0.0359	755	0.163		
		205.55	0.0594	811	0.173		
CURVE 3		215.83	0.0611	867	0.185		
		219.02	0.0621	922	0.196		
311.00	0.0728	281.76	0.0725				
366.00	0.0770	282.10	0.0720	CURVE 10			
422.00	0.0820	299.38	0.0766				
477.00	0.0887			22	0.0125		
533.00	0.0958	CURVE 7*		25	0.0142		
589.00	0.104			78	0.0382		
644.00	0.112	25.38	0.0133	194	0.0656		
700.00	0.119	23.60	0.0132	219	0.0705		
755.00	0.127	23.63	0.0131	294	0.0832		
811.00	0.135	24.38	0.0138				
		24.51	0.0136	CURVE 11			
CURVE 4		25.17	0.0150				
		92.17	0.0400	422	0.106		
311.00	0.0823	82.23	0.0394	478	0.119		
366.00	0.0866	208.73	0.0674	533	0.130		
422.00	0.0908*	224.65	0.0721	589	0.142		

*Not shown on plot



THERMAL CONDUCTIVITY OF
TITANIUM + CHROMIUM + ΣX_i ALLOYS
(Ti + Cr < 99.50%, or at least one X_i > 0.20%)
Cr M.P. 2118 K
Ti M.P. 1953 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}

FIG 304

SPECIFICATION TABLE NO. 304 THERMAL CONDUCTIVITY OF [TITANIUM + CHROMIUM + ΣX_i] ALLOYS

($Ti + Cr < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 304]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ti	Cr	Fe	O	Mo	C	Composition (continued), Specifications and Remarks
1	119, 718	L	1951	87-278	5-10	Ti 150A	96.2	2.8	1.3				0.02 N, and trace O ; specimen ~ 8 mm in dia and 72 mm long.
2	340	L	1956	364-705	10	Ti 150A(2)	95.65	2.71	1.4	0.105		0.05	0.076 N, 0.0092 H; specimen 0.75 in. in dia; supplied by Watertown Arsental.
3	340	L	1956	382-615	10	Cr-Mo	96.3	3.38	0.13	0.131	2.10	0.02	0.032 N, 0.0077 H; specimen 0.75 in. in dia; supplied by Watertown Arsental.

DATA TABLE NO. 304 THERMAL CONDUCTIVITY OF [TITANIUM + CHROMIUM + ΣX_i] ALLOYS

($Ti + Cr < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
87	0.062
194	0.103
278	0.131
CURVE 2	
363.7	0.152
369.3	0.141
370.7	0.150
406.8	0.147
412.3	0.138
414.6	0.152
419.3	0.142
433.2	0.141
447.1	0.152
452.6	0.145
459.6	0.156
474.8	0.141
474.8	0.152
492.9	0.136
503.4	0.156
539.6	0.165
542.9	0.152
549.0	0.134
549.0	0.165
560.1	0.143
568.4	0.155
596.2	0.141
625.7	0.138
634.6	0.148
672.1	0.141
700.7	0.165
704.6	0.161
CURVE 3	
381.8	0.163
383.2	0.173
387.3	0.168
426.2	0.175
434.6	0.164

T	k
CURVE 3 (cont.)	
438.7	0.159
440.7	0.168
452.6	0.168
477.6	0.156
477.6	0.161
477.6	0.167
518.4	0.165
526.8	0.174
546.2	0.166
552.6	0.164
574.0	0.161
588.7	0.176
610.1	0.161
514.6	0.165

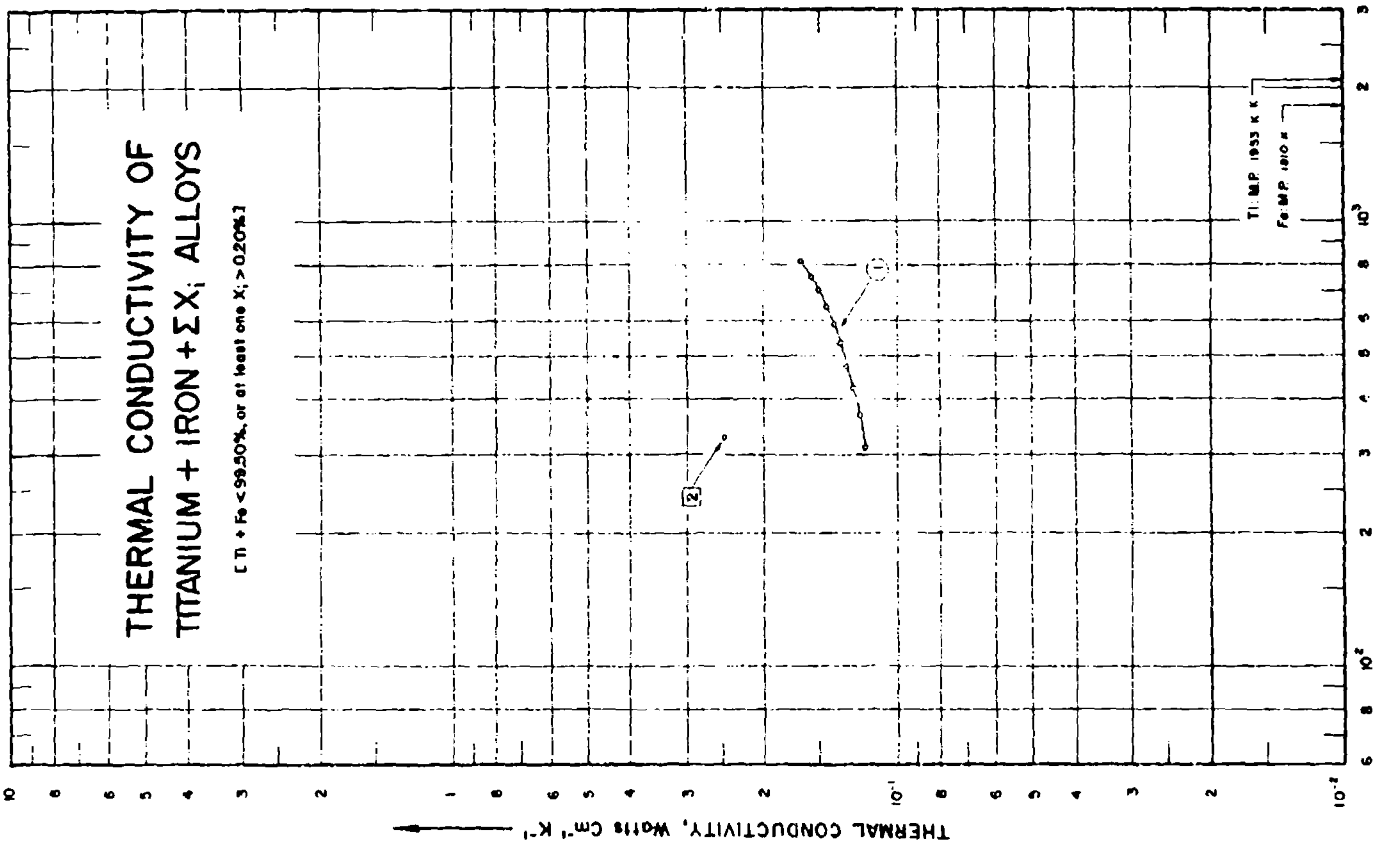

THERMAL CONDUCTIVITY OF
TITANIUM + IRON + ΣXi ALLOYS
[Ti + Fe < 99.50%, or at least one Xi > 0.20%]
Ti: M.P. 1953 K
Fe: M.P. 1810 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm-1 K-1

FIG 305

SPECIFICATION TABLE NO. 305 THERMAL CONDUCTIVITY OF [TITANIUM + IRON + ΣX_i] ALLOYS

($Ti + Fe < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 305]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ti	Fe	C	Cr	Mo	Si	Composition (continued), Specifications and Remarks
1	231	C	1958	311-811	< 5	Ti-140A	93.7	2.2		2.1	2.0		Specimen in a mill-annealed condition; measured in vacuum of ~ 2×10^{-5} mm Hg; electrical resistivity 78, 86, 95, 103, 111, 119, 125, 132, 138 and 143 μohm cm at 311, 366, 422, 477, 533, 589, 644, 700, 755 and 811 K respectively. Lead used as comparative material.
2	204	L	1937	327.4		Russian ferrocarbontitanium	45	34	13.5			7.5	Average composition of analysis.

DATA TABLE NO. 305 THERMAL CONDUCTIVITY OF [TITANIUM + IRON + ΣX_i] ALLOYS

($Ti + Fe < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1} K^{-1}$]

T	k
CURVE 1	
311.00	0.119
366.00	0.123
422.00	0.126
477.00	0.130
533.00	0.134
589.00	0.139
644.00	0.145
700.00	0.151
755.00	0.158
811.00	0.166
CURVE 2	
327.4	0.248

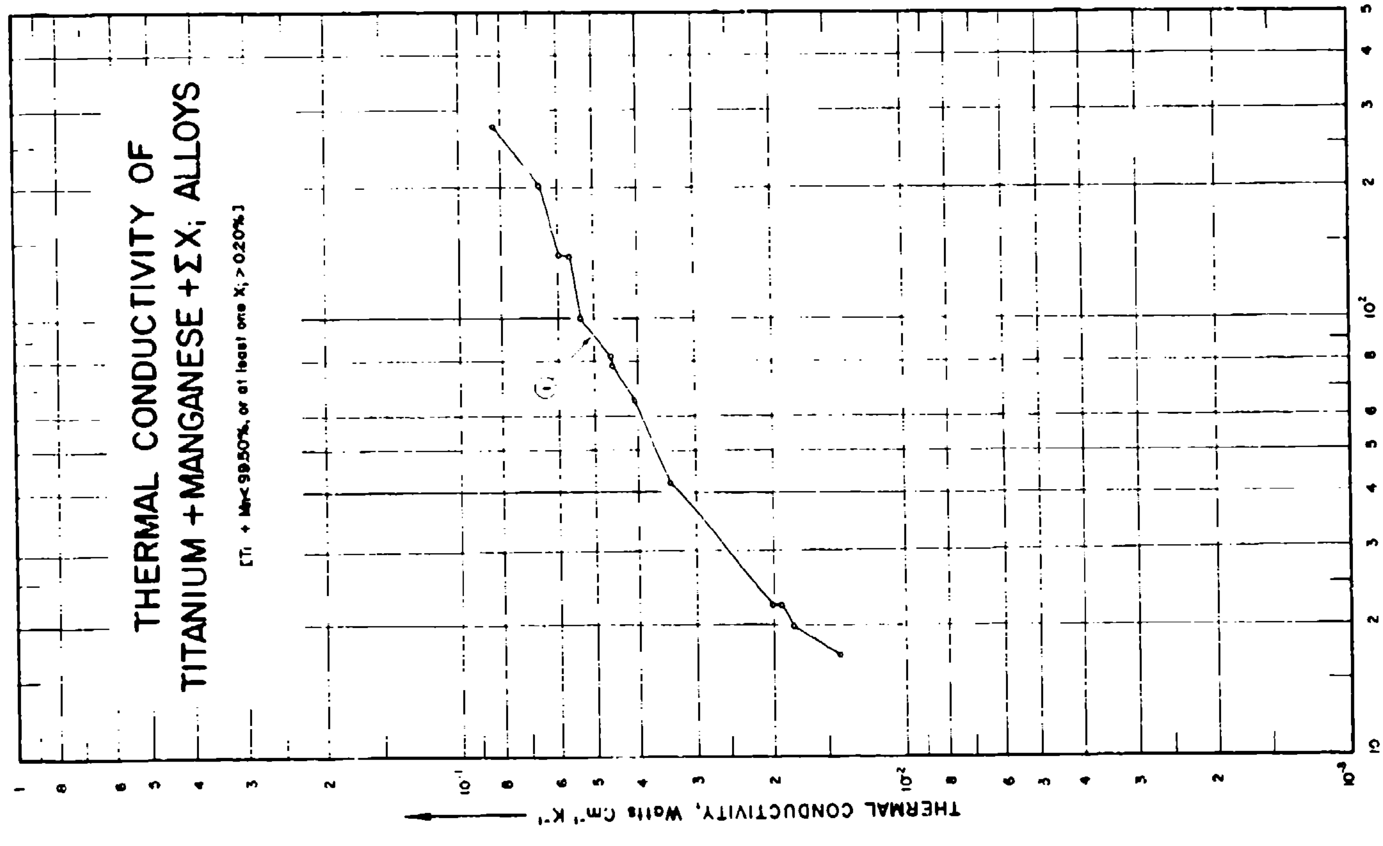

THERMAL CONDUCTIVITY OF
TITANIUM + MANGANESE + ΣXi ALLOYS
[Ti + Mn < 99.50%, or at least one Xi > 0.20%]
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 306

SPECIFICATION TABLE NO. 306 THERMAL CONDUCTIVITY OF [TITANIUM + MANGANESE + ΣX_i] ALLOYS

($Ti + Mn < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 306]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ti	Mn	Al	C	Composition (continued), Specifications and Remarks
1	159	L	1953	17-278	10.0	RC-130B	91.17	4.7	3.99	0.14	

DATA TABLE NO. 306 THERMAL CONDUCTIVITY OF [TITANIUM + MANGANESE + ΣX_i] ALLOYS

($Ti + Mn \leq 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
17.18	0.0142
19.91	0.0180
23.35	0.0193
23.40	0.0201
42.37	0.0339
65.26	0.0406
78.76	0.0456
82.59	0.0460
100.60	0.0536
141.20	0.0561
141.30	0.0598
204.10	0.0661
278.00	0.0837

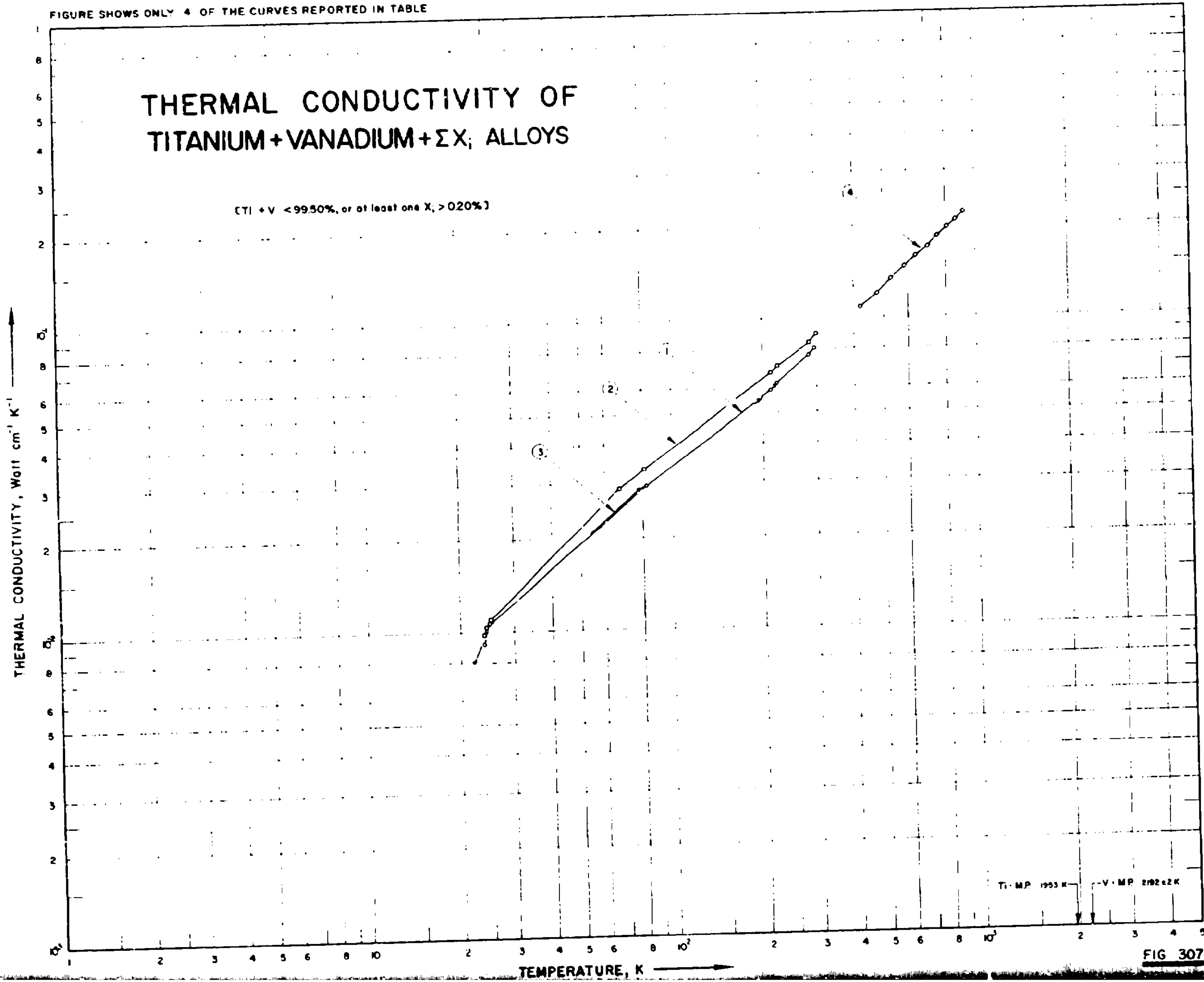


FIGURE SHOWS ONLY 4 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
TITANIUM + VANADIUM + ΣX$_i$ ALLOYS
[Ti + V < 99.50%, or at least one X$_i$ > 0.20%]
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
Ti · M.P. 1953 K
V · M.P. 2192 ± 2 K
(2)
(3)
(4)

FIG 307

SPECIFICATION TABLE NO. 307 THERMAL CONDUCTIVITY OF [TITANIUM + VANADIUM + ΣX_i] ALLOYS

($Ti + V + \Sigma X_i < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 307]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ti	V	Al	Cr	Fe	C	N_2	H	Composition (continued), Specifications and Remarks
1	831	L	1963	24-297	± 5	13V-11Cr-3Al	Bal	13.9	3.5	10.4	0.25	0.04	0.025	0.0114	Solution heat-treated at 1061 K for 20 min, air-cooled; aged at 755.4 K for 60 hrs, air-cooled; measurements done in high vacuum ($<10^{-5}$ mm Hg); specimen produced by Crucible Steel Co.
2	831	L	1963	24-301	± 5	2.5Al-16V	Bal	14.95	2.75		0.21	0.03	0.015	0.0066	Solution heat-treated at 1038.7 K for 30 min; aged at 805.4 K for 4 hrs; measurements done in high vacuum ($<10^{-5}$ mm Hg); specimen produced by Mallory-Sharon Metals Corporation.
3	939	L	1962	22-294		120VCA		13.9	3.5	10.4	0.25	0.04	0.025		Specimen 4 x 0.375 x 0.125 in.; supplied by Crucible Steel Co. of America; solution heat-treated at 1061 K for 20 min and aged at 755 K for 60 hrs; density 4.82 g cm^{-3}.
4	939	L	1962	422-922		120VCA		13.9	3.5	10.4	0.25	0.04	0.025		Specimen 10 x 0.5 x 0.125 in.; supplied by Crucible Steel Co. of America; solution heat-treated at 1061 K for 20 min and aged at 755 K for 60 hrs; density 4.82 g cm^{-3}.
5	939	L	1962	22-294		2.5Al-16V		14.95	2.75		0.21	0.3	0.015		Specimen 4 x 0.375 x 0.125 in.; supplied by Reactive Metals, Inc.; solution heat-treated at 1039 K for 30 min and aged at 805 K for 4 hrs; density 4.65 g cm^{-3}.
6	939	L	1962	422-922		2.5Al-16V		14.95	2.75		0.21	0.3	0.015		Specimen 10 x 0.5 x 0.125 in.; supplied by Reactive Metals, Inc.; solution heat-treated at 1039 K for 30 min and aged at 805 K for 4 hrs; density 4.65 g cm^{-3}.

DATA TABLE NO. 307 THERMAL CONDUCTIVITY OF [TITANIUM + VANADIUM + ΣX_i] ALLOYS

($Ti + V < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		**CURVE 4**	
23.89	0.0092	422	0.109
23.91	0.0092*	478	0.121
24.96	0.0108	533	0.135
24.96	0.0109*	589	0.147
25.34	0.0109	644	0.159
25.37	0.0111*	700	0.171
82.06	0.0294	755	0.185
212.78	0.0590	811	0.197
223.90	0.0623	867	0.209
283.96	0.0767	922	0.221
296.65	0.0802		
		CURVE 5*	
CURVE 2		22	0.0085
23.90	0.0098	25	0.0107
23.92	0.0099*	78	0.0320
24.38	0.0104	194	0.0633
24.41	0.0104*	219	0.0696
25.02	0.0109*	294	0.0869
25.08	0.0110		
25.37	0.0108*	**CURVE 6***	
25.40	0.0108*		
67.33	0.0281*	422	0.109
81.59	0.0327*	478	0.121
81.65	0.0332	533	0.135
212.70	0.0673	589	0.147
224.92	0.0707	644	0.159
284.61	0.0839	700	0.171
301.12	0.0889*	755	0.185
301.13	0.0891	811	0.197
		867	0.209
CURVE 3		922	0.221
22	0.0080		
25	0.0107*		
78	0.0236		
194	0.0545		
219	0.0606		
294	0.0796*		

* Not shown on plot

SPECIFICATION TABLE NO. 308 THERMAL CONDUCTIVITY OF [TITANIUM + ΣX_i] ALLOYS $Ti + \Sigma X_i$

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	340	L	1956	418-927	10.0	Ti 150A(1)	Composition unknown.

DATA TABLE NO. 308 THERMAL CONDUCTIVITY OF [TITANIUM + ΣX_i] ALLOYS $Ti + \Sigma X_i$

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 1 (cont.)*	
418.44	0.166	815.7	0.163
421.2	0.169	917.9	0.169
493.4	0.171	926.8	0.174
497.1	0.169		
516.5	0.161		
524.8	0.163		
535.9	0.177		
610.1	0.164		
621.2	0.168		
653.4	0.156		
663.7	0.162		
731.8	0.170		
746.2	0.175		
801.8	0.166		

* No graphical presentation

SPECIFICATION TABLE NO. 309 THERMAL CONDUCTIVITY OF [TUNGSTEN + IRON + ΣX_i] ALLOYS W + Fe + ΣX_i

(W + Fe < 99.50% or at least one X_i > 0.20%)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) W	Fe	C	Composition (continued), Specifications and Remarks
1	204	L	1937	340.7		Ferrotungsten, 32	80.5	12.02	0.48	

DATA TABLE NO. 309 THERMAL CONDUCTIVITY OF [TUNGSTEN + IRON + ΣX_i] ALLOYS W + Fe + ΣX_i

(W + Fe < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
340.7	0.468

*No graphical presentation

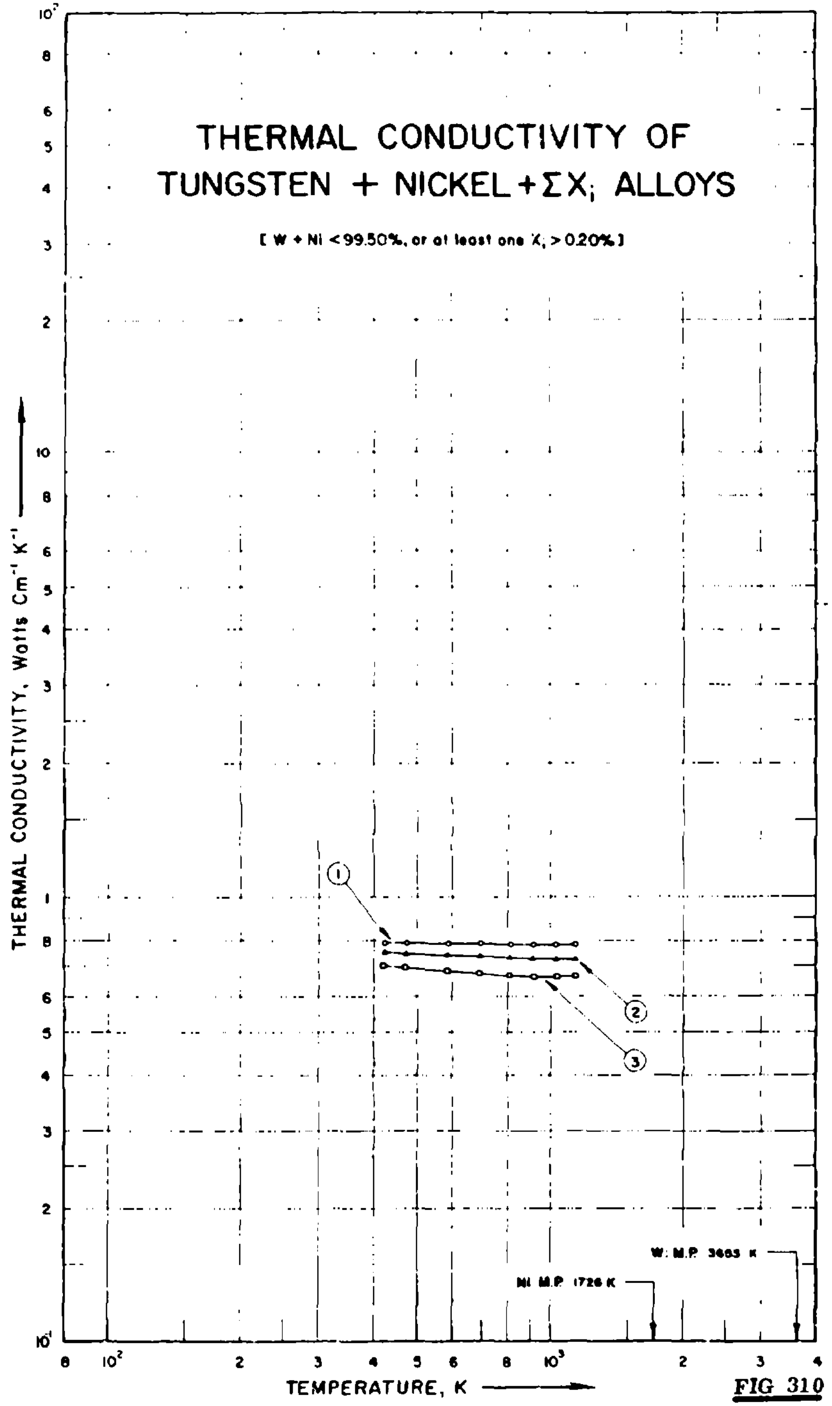

THERMAL CONDUCTIVITY OF
TUNGSTEN + NICKEL + ΣX; ALLOYS
[W + Ni < 99.50%, or at least one X; > 0.20%]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
W: M.P. 3683 K
Ni M.P. 1726 K
1
2
3

FIG 310

SPECIFICATION TABLE NO. 310 THERMAL CONDUCTIVITY OF [TUNGSTEN + NICKEL + ΣX_i] ALLOYS

($W + Ni < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 310]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) W	Ni	Cu	B	Composition (continued), Specifications and Remarks
1	595		1961	422-1144			90	6	4		
2	595		1961	422-1144			90.4	6.3	2.0	0.15	
3	595		1961	422-1144			90.4	6.3	2.0	0.15	

DATA TABLE NO. 310 THERMAL CONDUCTIVITY OF [TUNGSTEN + NICKEL + ΣX_i] ALLOYS

($W + Ni < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
422.1	0.790
477.6	0.790
586.7	0.790
699.8	0.788
810.9	0.787
922.1	0.786
1033.2	0.785
1144.3	0.784
CURVE 2	
422.1	0.753
477.6	0.748
588.7	0.741
699.8	0.738
810.9	0.732
922.1	0.729
1033.2	0.728
1144.3	0.729
CURVE 3	
422.1	0.701
477.6	0.697
588.7	0.684
699.8	0.675
810.9	0.670
922.1	0.667
1033.2	0.665
1144.3	0.665

FIGURE SHOWS ONLY 6 OF THE CURVES REPORTED IN TABLE

THERMAL CONDUCTIVITY OF URANIUM + MOLYBDENUM + ΣX_i ALLOYS

[U + Mo < 99.50%, or at least one X_i > 0.20%]

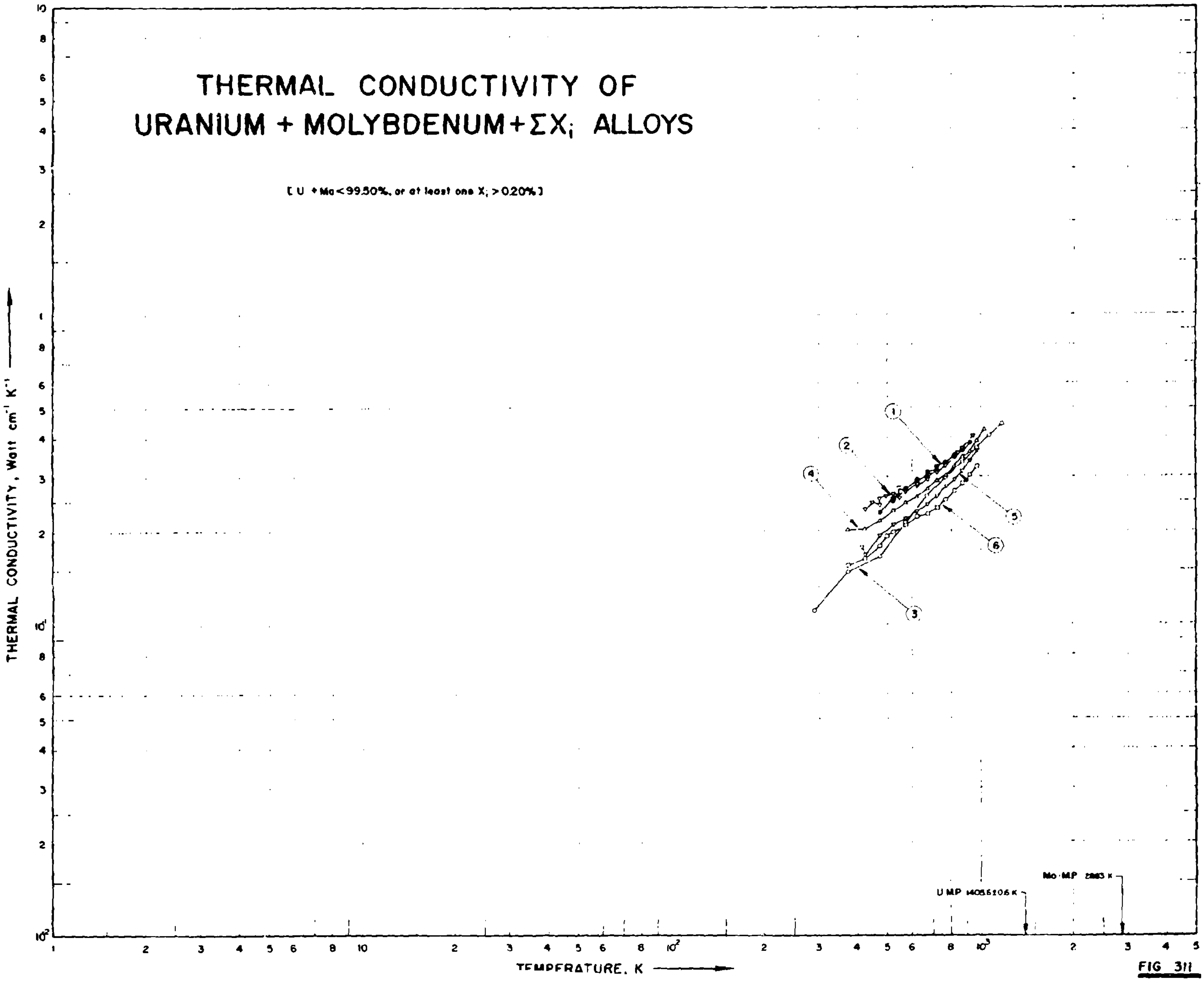


FIG 311

SPECIFICATION TABLE NO. 311 THERMAL CONDUCTIVITY OF [URANIUM + MOLYBDENUM + ΣX_i] ALLOYS

($U + Mo < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 311]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Mo	Ru	Rh	Pd	Zn	Composition (continued), Specifications and Remarks
1	217	C	1959	473-923	4	U-3% FS alloy	96.974	1.5	1.2	0.16	0.12	0.04	0.006 Nb; specimen 15 cm long and 2 cm in dia; melt in vacuum and cast into a water-cooled copper mold; Inconel used as comparative material.
2	217	C	1959	423-948	4	U-3% FS alloy	96.974	1.5	1.2	0.16	0.12	0.04	0.006 Nb; the above specimen used Armco iron as comparative material.
3	538	L	1956	293-1173	±5	Fissium-type alloy	94.95	2.56	1.55	0.30	0.54	0.10	Melt and cast; forged at 870 C, rolled from a helium atmosphere furnace at 675 C then machined; measured in vacuum of ~1 x 10^{-6} mm Hg.
4	421	C	1961	373-1023	4	U-5% FS alloy; casting No. 870	95.676	2.06	1.86	0.195	0.136	0.063	0.01 Nb; cast; Armco iron used as comparative material.
5	421	C	1961	413-973	4	U-8% FS alloy; casting No. 743	92.342	3.73	3.12	0.415	0.28	0.096	0.017 Nb; cast; Armco iron used as comparative material.
6	421	C	1961	373-973	4	U-10% FS alloy; casting No. 744	90.334	4.63	4.00	0.54	0.358	0.118	0.02 Nb; cast; Armco iron used as comparative material.

DATA TABLE NO. 311 THERMAL CONDUCTIVITY OF [URANIUM + MOLYBDENUM + ΣX_i] ALLOYS

(U + Mo < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
473.2	0.230
523.2	0.247
523.2	0.255
573.2	0.272
623.2	0.293
623.2	0.289
673.2	0.301
673.2	0.310
723.2	0.314*
723.2	0.322
773.2	0.331*
773.2	0.335
823.2	0.351
823.2	0.347
873.2	0.364
923.2	0.385

CURVE 2

T	k
423.2	0.234
448.2	0.247
473.2	0.243
473.2	0.255
498.2	0.259
523.2	0.259*
523.2	0.264
532.2	0.259
548.2	0.255
548.2	0.276
573.2	0.268
573.2	0.272*
623.2	0.285
623.2	0.280
623.2	0.289*
631.2	0.289*
673.2	0.293
673.2	0.301
723.2	0.310
723.2	0.314
724.2	0.305*
773.2	0.326
773.2	0.331*

CURVE 2 (cont.)

T	k
823.2	0.347*
848.2	0.356
873.2	0.368
948.2	0.402

CURVE 3

T	k
293.2	0.110
373.2	0.148
473.2	0.165
573.2	0.212
673.2	0.260
773.2	0.298
873.2	0.334
973.2	0.370
1073.2	0.407
1173.2	0.441

CURVE 4

T	k
373.2	0.261
423.2	0.202
473.2	0.215
523.2	0.232
573.2	0.246
623.2	0.258
673.2	0.272
723.2	0.290
773.2	0.301
823.2	0.322
873.2	0.347
923.2	0.360
973.2	0.389
1023.2	0.427

CURVE 5

T	k
413.2	0.176
423.2	0.167
473.2	0.191
523.2	0.209
573.2	0.218

CURVE 5 (cont.)

T	k
623.2	0.230
673.2	0.243
723.2	0.259
773.2	0.277
823.2	0.291
873.2	0.312
923.2	0.337
973.2	0.364

CURVE 6

T	k
373.2	0.155
423.2	0.163
473.2	0.178
498.2	0.192
523.2	0.198
573.2	0.208
623.2	0.221
673.2	0.226
723.2	0.238
773.2	0.251
823.2	0.268
873.2	0.285
923.2	0.303
973.2	0.322

* Not shown on plot

SPECIFICATION TABLE NO. 312 THERMAL CONDUCTIVITY OF [URANIUM + ZIRCONIUM + ΣX_i] ALLOYS $U + Zr + \Sigma X_i$

($U + Zr < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Mo	Nb	Composition (continued), Specifications and Remarks
1	421	C	1961	423-973		U-5 W/O Fs alloy; casting No. 896	2.54	1.85	0.01	0.135 Pd, 0.189 Rh, 1.76 Ru; specimen 2 cm in dia and 15 cm long; machined from the cast ingot prepared by vacuum induction melting of binary alloys of uranium with fission elements in the form of buttons (prepared by arc melting) in thoria-coated graphite crucible, and then bottom pouring into a water-cooled copper mold at approx 1200 C; measured in vacuum; Armco iron used as comparative material.

DATA TABLE NO. 312 THERMAL CONDUCTIVITY OF [URANIUM + ZIRCONIUM + ΣX_i] ALLOYS $U + Zr + \Sigma X_i$

($U + Zr < 99.50\%$ or at least one $X_i > 0.20\%$)

T	k
CURVE 1*	
423.2	0.211
448.2	0.226
473.2	0.228
523.2	0.243
573.2	0.253
623.2	0.265
673.2	0.279
698.2	0.289
723.2	0.289
773.2	0.303
798.2	0.326
823.2	0.315
873.2	0.332
923.2	0.353
948.2	0.379
973.2	0.377

* No graphical presentation

SPECIFICATION TABLE NO. 313 THERMAL CONDUCTIVITY OF [ZINC + ALUMINUM + ΣX_i] ALLOYS $Zn + Al + \Sigma X_i$

($Zn + Al < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zn	Al	Cu	Composition (continued), Specifications and Remarks
1	17	L	1958	293-353	±1.0	Zamak Nr410	95.18	3.90	0.87	0.008 Fe, 0.042 Mg, 0.024 Si, trace Bi, Cd, Pb, Sn and Tl.
2	17	L	1958	293-353	±1.0	Zamak Nr430	92.33	4.88	2.71	0.010 Fe, 0.043 Mg, 0.022 Si, trace Bi, Cd, Pb, Sn and Tl.

DATA TABLE NO. 313 THERMAL CONDUCTIVITY OF [ZINC + ALUMINUM + ΣX_i] ALLOYS $Zn + Al + \Sigma X_i$

($Zn + Al < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
293.2	1.13
323.2	1.14
353.2	1.15
CURVE 2*	
293.2	1.12
323.2	1.13
353.2	1.14

* No graphical presentation

SPECIFICATION TABLE NO. 314 THERMAL CONDUCTIVITY OF [ZINC + LEAD + ΣX_i] ALLOYS $Zn + Pb + \Sigma X_i$

($Zn + Pb < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zn	Pb	Cu	Composition (continued), Specifications and Remarks
1	77	E	1900	291, 373		Commercial zinc; Zn 1	98.6	1.1	0.03	0.25 Cu, 0.03 Fe.

DATA TABLE NO. 314 THERMAL CONDUCTIVITY OF [ZINC + LEAD + ΣX_i] ALLOYS $Zn + Pb + \Sigma X_i$

($Zn + Pb < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
291.2	1.115
373.2	1.108

*No graphical presentation

SPECIFICATION TABLE NO. 315 THERMAL CONDUCTIVITY OF [ZIRCONIUM + ALUMINUM + ΣX_i] ALLOYS $Zr + Al + \Sigma X_i$

($Zr + Al < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Al	Mo	Sn	Composition (continued), Specifications and Remarks
1	956	R	1960	747-868			1.5	1.5	1.5	Prepared from reactor-grade Zr sponge by double-arc melting; cast into 6 in. dia, 35 lb ingots, and hard-rolled to 0.125 in. strip then vacuum annealed at 788 C for 24 hrs.
2	956	R	1960	696-871			3.0		1.5	Similar to the above specimen.
3	956	R	1960	728-869			3.0		3.0	Similar to the above specimen.

DATA TABLE NO. 315 THERMAL CONDUCTIVITY OF [ZIRCONIUM + ALUMINUM + ΣX_i] ALLOYS $Zr + Al + \Sigma X_i$

($Zr + Al < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 3*	
747	0.166	728	0.140
761	0.168	760	0.144
808	0.171	792	0.147
868	0.185	825	0.151
CURVE 2*		869	0.159
696	0.125		
740	0.128		
820	0.137		
871	0.144		

*No graphical presentation

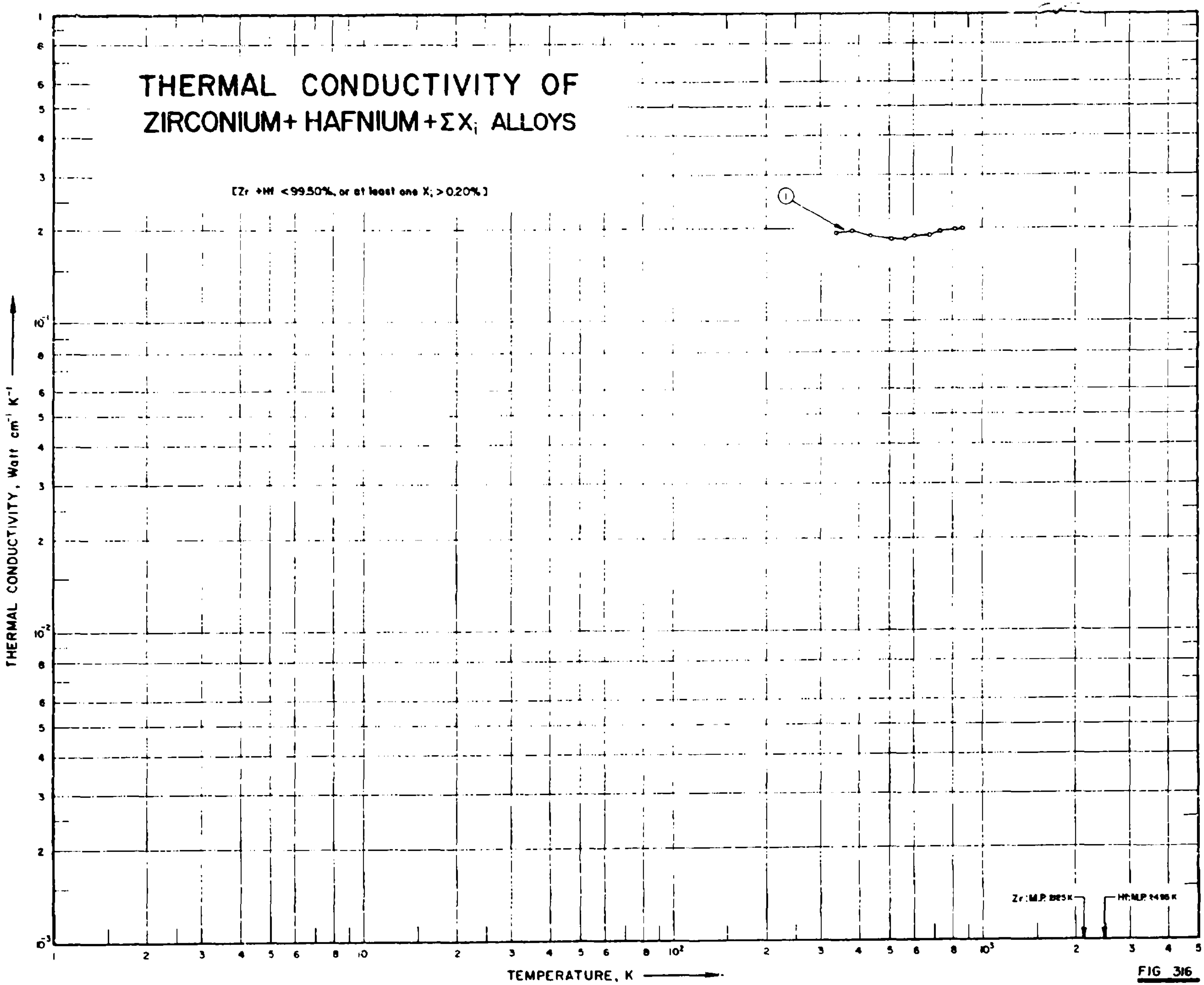

THERMAL CONDUCTIVITY OF
ZIRCONIUM+ HAFNIUM+ΣXi ALLOYS
[Zr +Hf <99.50%, or at least one Xi >0.20%]
1
Zr: M.P. 2125 K
Hf: M.P. 2495 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 316

SPECIFICATION TABLE NO. 316 THERMAL CONDUCTIVITY OF [ZIRCONIUM + HAFNIUM + ΣX_i] ALLOYS

($Zr + Hf < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 316]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Hf	C	Composition (continued), Specifications and Remarks
1	441	L	1957	340-863			98.73	0.97	0.3	Electrical resistivity 62.1, 69.4, 77.5, 89.3, 97.1, 101.0, 108.6, 113.6, 123.4, and 128.2 μ ohm cm at 66.3, 110.5, 165.1, 237.3, 292.8, 336.3, 403.0, 457.6, 546.0, and 589.5 C, respectively.

DATA TABLE NO. 316 THERMAL CONDUCTIVITY OF [ZIRCONIUM + HAFNIUM + ΣX_i] ALLOYS

(Zr + Hf < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
339.5	0.194
383.7	0.196
438.3	0.189
510.5	0.185
566.0	0.185
603.5	0.189
676.2	0.190
730.8	0.196
819.2	0.199
862.7	0.200

SPECIFICATION TABLE NO. 317 THERMAL CONDUCTIVITY OF [ZIRCONIUM + MOLYBDENUM + ΣX_i] ALLOYS Zr + Mo + ΣX_i

(Zr + Mo < 99.50% or at least one X_i > 0.20%)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mo	Al	Sn	Composition (continued), Specifications and Remarks
1	956	R	1960	747-868			1.5	1.5	1.5	Prepared from reactor-grade Zr sponge by double-arc melting; cast into 6 in. dia, 35 lb ingots; hard-rolled to 0.125 in. strip then vacuum annealed at 1061 K for 24 hrs.

DATA TABLE NO. 317 THERMAL CONDUCTIVITY OF [ZIRCONIUM + MOLYBDENUM + ΣX_i] ALLOYS Zr + Mo + ΣX_i

(Zr + Mo < 99.50% or at least one X_i > 0.20%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
747	0.166
761	0.168
808	0.171
868	0.185

*No graphical presentation

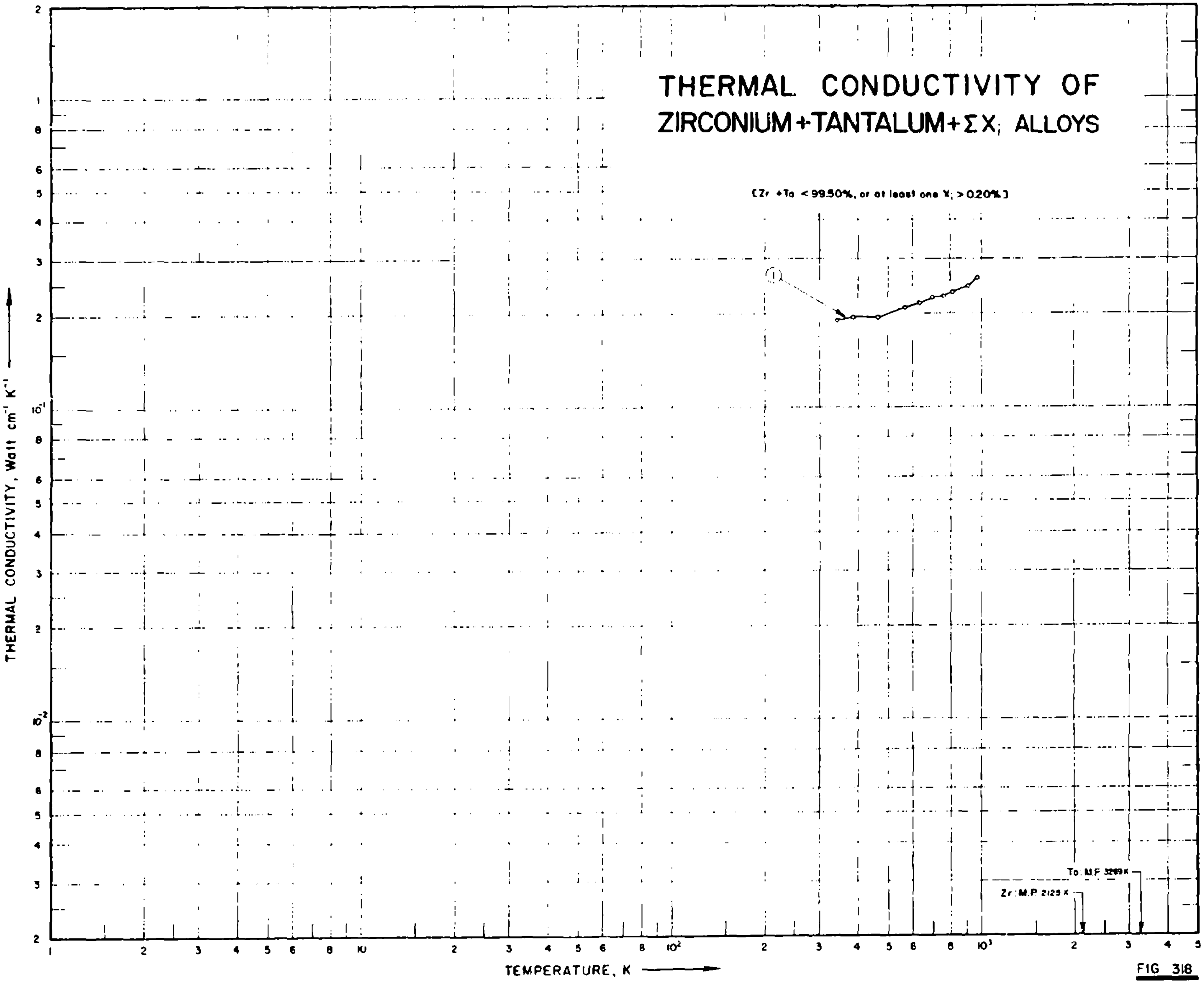

THERMAL CONDUCTIVITY OF
ZIRCONIUM+TANTALUM+ΣX; ALLOYS
[Zr + Ta < 99.50%, or at least one X_i > 0.20%]
1
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ta: M.P. 3269 K
Zr: M.P. 2125 K

FIG. 318

SPECIFICATION TABLE NO. 318 THERMAL CONDUCTIVITY OF [ZIRCONIUM + TANTALUM + ΣX_i] ALLOYS

($Zr + Ta < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Date Reported in Figure and Table No. 318]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Ta	C	Hf	Composition (continued), Specifications and Remarks
1	441	L	1957	344-970			97.75	0.98	0.3	0.97	Electrical resistivity 58.4, 66.2, 79.3, 92.5, 100.2, 106.3, 113.6, 119.0, 126.5, and 129.8 μ ohm cm at 70.5, 114.0, 192.0, 294.8, 259.8, 422.0, 479.8, 535.8, 635.0, and 697 C respectively.

DATA TABLE NO. 318 THERMAL CONDUCTIVITY OF [ZIRCONIUM + TANTALUM + ΣX_i] ALLOYS

($Zr + Ta < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
343.7	0.1925
387.2	0.1971
465.2	0.1962
568.0	0.2100
633.0	0.2184
695.2	0.2264
753.0	0.2297
808.7	0.2360
908.2	0.2464
970.2	0.2628

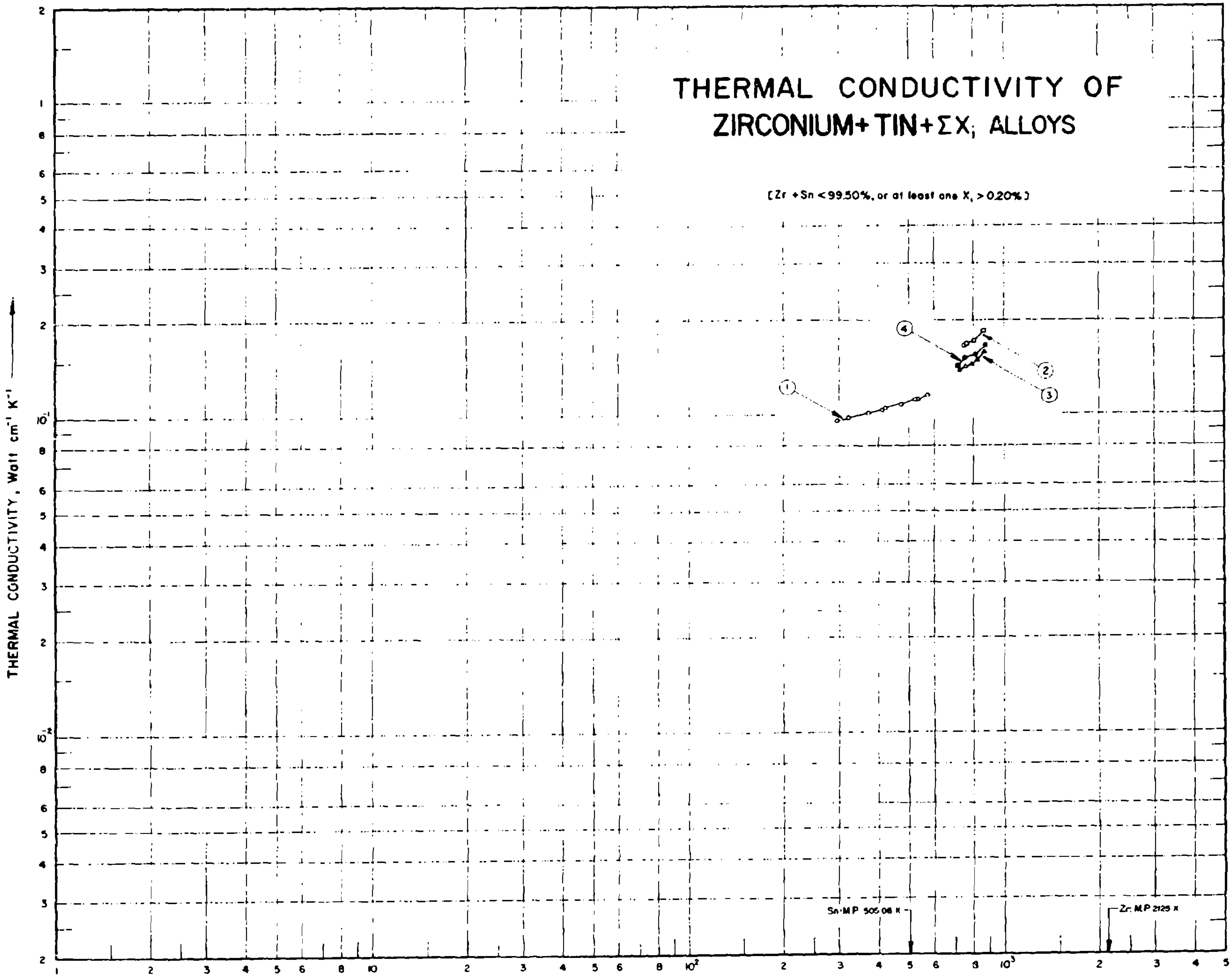

THERMAL CONDUCTIVITY OF
ZIRCONIUM+TIN+ΣX; ALLOYS
[Zr + Sn < 99.50%, or at least one X, > 0.20%]
1
2
3
4
Sn: M.P. 505.06 K
Zr: M.P. 2125 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 319

SPECIFICATION TABLE NO. 319 THERMAL CONDUCTIVITY OF [ZIRCONIUM + TIN + ΣX_i] ALLOYS

($Zr + Sn < 99.50\%$ or at least one $X_i > 0.20\%$)

[For Data Reported in Figure and Table No. 319]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Sn	Al	C	Fe	Hf	N	Ni	Composition (continued), Specifications and Remarks
1	442	C	1951	298-573	±3.0		Bal.	4.85	0.009	0.0125	0.235	0.024	0.0075	0.0055	0.014 Ti.
2	956	R	1960	747-868			Bal.	1.5	1.5						1.5 Mo; prepared from reactor-grade Zr sponge by double-arc melting; cast into 6 in. dia, 35 lb ingots; hard-rolled to 0.125 in. strip, then vacuum annealed at 878 C for 24 hrs.
3	956	R	1960	728-869			Bal.	3.0	3.0						Prepared from reactor-grade Zr sponge by double-arc melting; cast into 6 in. dia, 35 lb ingots; hard-rolled to 0.125 in. strip, then vacuum annealed at 878 C for 24 hrs.
4	956	R	1960	716-875			Bal.	3.0	1.5						Similar to the above specimen.

DATA TABLE NO. 319 THERMAL CONDUCTIVITY OF [ZIRCONIUM + TIN + ΣX_i] ALLOYS

($Zr + Sn < 99.50\%$ or at least one $X_i > 0.20\%$)

[*Temperature*, T, K; *Thermal Conductivity*, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
298.2	0.096
323.2	0.098
373.2	0.101
415.2	0.104
423.2	0.105
473.2	0.108
523.2	0.112
533.2	0.112
573.2	0.116
CURVE 2	
747	0.166
751	0.168
808	0.171
868	0.185
CURVE 3	
728	0.140
760	0.144
792	0.147
825	0.151
869	0.159
CURVE 4	
716	0.144
753	0.151
818	0.156
875	0.166

SPECIFICATION TABLE NO. 320 THERMAL CONDUCTIVITY OF [ZIRCONIUM + URANIUM + ΣX_i] ALLOYS $Zr + U + \Sigma X_i$

($Zr + U < 99.50\%$ or at least one $X_i > 0.20\%$)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	U	B	Composition (continued), Specifications and Remarks
1	27	C	1953	323-673		513	Bal	4.34	0.04	0.09 Cr, 0.125 Fe, 0.013 N_2, 0.027 Ni, and 1.33 Sn; arc-melted, forged, and rolled at 871 C.

DATA TABLE NO. 320 THERMAL CONDUCTIVITY OF [ZIRCONIUM + URANIUM + ΣX_i] ALLOYS $Zr + U + \Sigma X_i$

($Zr + U < 99.50\%$ or at least one $X_i > 0.20\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
323.20	0.145
373.20	0.141
423.20	0.138
473.20	0.137
523.20	0.137
573.20	0.137
623.20	0.138
673.20	0.139

*No graphical presentation

SPECIFICATION TABLE NO. 321 THERMAL CONDUCTIVITY OF [ZIRCONIUM + ΣX_i] ALLOYS Zr + ΣX_i

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	Composition (continued), Specifications and Remarks
1	97	L	1952	2.3-27	2-3	Zr 1	≈98	Polycrystalline; annealed.

DATA TABLE NO. 321 THERMAL CONDUCTIVITY OF [ZIRCONIUM + ΣX_i] ALLOYS Zr + ΣX_i

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
2.32	0.0292
3.27	0.0396
4.30	0.0602
7.23	0.0998
10.75	0.138
14.11	0.179
16.90	0.206
20.86	0.237
21.85	0.246
23.14	0.255
24.82	0.262
27.30	0.268

*No graphical presentation

FIGURE SHOWS ONLY 42 OF THE CURVES REPORTED IN TABLE

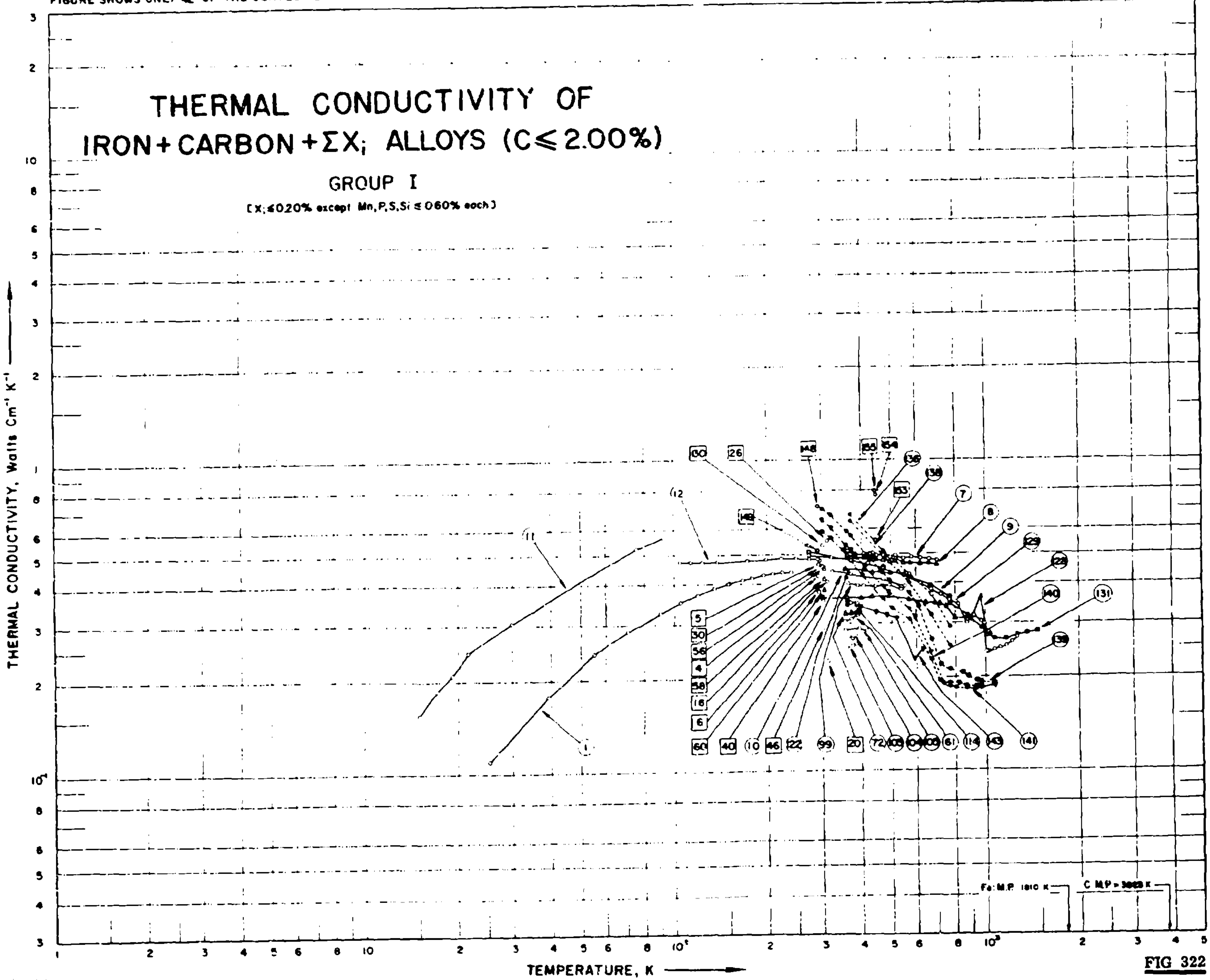


FIG 322

SPECIFICATION TABLE NO. 322 THERMAL CONDUCTIVITY OF [IRON + CARBON + ΣX_i] ALLOYS ($C \leq 2.00\%$) GROUP I

($X_i < 0.20\%$ except Mn, P, S, Si $\leq 0.60\%$ each)

[For Data Reported in Figure and Table No. 322]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight per cent) C	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
1	115	L	1951	26-240		SAE 1095	0.93		0.34			0.26	0.10 Cr; 0.10 Ni; < 0.05 Mo.
2	129	C	1953	373-818	3.0-5.0	S1	0.83		0.27	0.017	0.015	0.16	Annealed at 800 C for 2 hrs and cooled in furnace.
3	129	C	1933	364-773	3.0-5.0	$S1_Q$	0.83		0.27	0.017	0.015	0.16	The above specimen normalized at 900 C for 10 min and air-cooled, reheated to 800 C for 10 min and quenched in water, and reheated to 250 C for 1 hr and furnace cooled.
4	167		1935	293			0.6		≈0.5			≈0.2	
5	167		1935	293			1.0		≈0.5			≈0.2	
6	167		1935	293			1.5		≈0.5			≈0.2	
7	31	L	1933	364-705	2.0	British steel; 4	0.92		0.56	0.032	0.039	0.177	Normalized at 900 C.
8	31	L	1933	363-703	2.0	British steel; 5	1.09		0.46	0.034	0.023	0.058	Normalized at 900 C.
9	169	R	1936	273-773		Steel 3	0.57		0.55			0.38	
10	169	R	1936	326-554		Steel 5	1.00		0.50			0.15	
11	104	L	1951	15- 93		1164 A/4	0.14		0.07			0.08	Heated to 800 C and cooled in furnace.
12	88	L	1908	105-296		Silver steel	1.0						Density = 7.84 at 24 C.
13	170	L	1926	313		4.1	0.90		0.41	0.014	0.015	0.28	Annealed.
14	170	L	1926	313		4.2	0.90		0.41	0.014	0.015	0.28	Forged.
15	170	L	1926	313		5.1	1.20		0.44	0.014	0.01	0.30	Annealed.
16	170	L	1926	313		5.2	1.20		0.44	0.014	0.01	0.30	Forged.
17	170	L	1926	313		5.3b	1.20		0.44	0.014	0.01	0.30	Annealed and then hardened at 800 C.
18	170	L	1926	313		6.1	1.35		0.54	0.014	0.015	0.26	Annealed.
19	170	L	1926	313		6.2	1.35		0.54	0.014	0.015	0.26	Forged.
20	170	L	1926	313		6.3b	1.35		0.54	0.014	0.015	0.26	Annealed and then hardened at 800 C.
21	170	L	1926	313		7.1	1.50		0.29	0.013	0.02	0.12	Annealed.
22	170	L	1926	313		7.2	1.50		0.29	0.013	0.02	0.12	Forged.
23	170	L	1926	313		7.3b	1.50		0.29	0.013	0.02	0.12	Annealed and then hardened at 800 C.
24	170	L	1926	313		8.1	1.70		0.29	0.013	0.03	0.08	Annealed.
25	170	L	1926	313		8.2	1.70		0.29	0.013	0.03	0.08	Forged.
26	170	L	1926	313		A	0.50		0.32			0.24	
27	170	L	1926	313		B	0.71		0.18			0.24	
28	176	E	1920	303		1a	0.60						Annealed at 900 C and slowly cooled.
29	176	E	1920	303		1b	0.60						Annealed at 1100 C and quickly cooled.
30	188	E	1919	303		1a	0.30						Annealed at 900 C and slowly cooled.

SPECIFICATION TABLE NO. 322 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight per cent) C	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
31	188	E	1919	303		1b	0.60						Annealed at 900 C and slowly cooled.
32	171	E	1917	303		Krupp steel;11a	0.56	0.09	0.30	0.016	0.034	0.18	Forged.
33	171	E	1917	303		Krupp steel;11b	0.56	0.09	0.30	0.016	0.034	0.18	Annealed at 900 C for 1 hr in vacuum.
34	171	E	1917	303		Krupp steel;11c	0.56	0.09	0.30	0.016	0.034	0.18	Oil-quenched from 900 C.
35	171	E	1917	303		Krupp steel;12a	0.64	0.09	0.27	0.10	0.028	0.06	Forged.
36	171	E	1917	303		Krupp steel;12b	0.64	0.09	0.27	0.10	0.028	0.06	Annealed at 900 C for 1 hr in vacuum.
37	171	E	1917	303		Krupp steel;12c	0.64	0.09	0.27	0.10	0.028	0.06	Oil-quenched from 900 C.
38	171	E	1917	303		Krupp steel;15a	0.75	0.07	0.35	0.010	0.018	0.10	Forged.
39	171	E	1917	303		Krupp steel;15b	0.75	0.07	0.35	0.010	0.018	0.10	Annealed at 900 C for 1 hr in vacuum.
40	171	E	1917	303		Krupp steel;15c	0.75	0.07	0.35	0.010	0.018	0.10	Oil-quenched from 900 C.
41	171	E	1917	303		Krupp steel;16a	0.80	0.08	0.30	0.012	0.016	0.10	Forged.
42	171	E	1917	303		Krupp steel;16b	0.80	0.08	0.30	0.012	0.016	0.10	Annealed at 900 C for 1 hr in vacuum.
43	171	E	1917	303		Krupp steel;16c	0.80	0.08	0.30	0.012	0.016	0.10	Oil-quenched from 900 C.
44	171	E	1917	303		Krupp steel;18a	0.94	0.08	0.35	0.016	0.016	0.13	Forged.
45	171	E	1917	303		Krupp steel;18b	0.94	0.08	0.35	0.016	0.018	0.13	Annealed at 900 C for 1 hr in vacuum.
46	171	E	1917	303		Krupp steel;18c	0.94	0.08	0.35	0.016	0.018	0.13	Oil-quenched from 900 C.
47	171	E	1917	303		Krupp steel;20a	1.02	0.05	0.36	0.013	0.014	0.08	Forged.
48	171	E	1917	303		Krupp steel;20b	1.02	0.05	0.36	0.013	0.014	0.08	Annealed at 900 C for 1 hr in vacuum.
49	171	E	1917	303		Krupp steel;20c	1.02	0.05	0.36	0.013	0.014	0.08	Oil-quenched from 900 C.
50	171	E	1917	303		Krupp steel;26a	1.30	0.06	0.40	0.046	0.018	0.08	Forged.
51	171	E	1917	303		Krupp steel;26b	1.30	0.06	0.40	0.046	0.018	0.08	Annealed at 900 C for 1 hr in vacuum.
52	171	E	1917	303		Krupp steel;26c	1.30	0.06	0.40	0.046	0.018	0.08	Oil-quenched from 900 C.
53	171	E	1917	303		Krupp steel;30a	1.50	0.05	0.36	0.020	0.020	0.05	Forged.
54	171	E	1917	303		Krupp steel;30b	1.50	0.05	0.36	0.020	0.020	0.05	Annealed at 900 C for 1 hr in vacuum.
55	171	E	1917	303		Krupp steel;30c	1.50	0.05	0.36	0.020	0.020	0.05	Oil-quenched from 900 C.
56	172	E	1927	307		3	0.70		0.21	0.029	0.023	0.27	
57	172	E	1927	307		4	0.885		0.19	0.028	0.015	0.34	
58	172	E	1927	307		5	1.015		0.20	0.027	0.020	0.27	
59	172	E	1927	307		6	1.185		0.22	0.017	0.031	0.28	
60	172	E	1927	307		7	1.480		0.18	0.026	0.020	0.24	
61	189	L	1934	356-390	2.0-5.0	Tool steel; A_Q	1.41	0.01	0.23	0.037	0.006	0.158	Water-quenched from 775 C.

SPECIFICATION TABLE NO. 322 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	C	Composition (weight per cent) Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
62	189	L	1934	361- 390	2.0-5.0	$A_{T.\,150\,C}$	1.41	0.01	0.23	0.037	0.006	0.158	Tempered for 30 min at 150 C and air-cooled.
63	189	L	1934	366- 427	2.0-5.0	$A_{T.\,200\,C}$	1.41	0.01	0.23	0.037	0.006	0.158	Tempered for 30 min at 200 C and air-cooled.
64	189	L	1934	364- 468	2.0-5.0	$A_{T.\,250\,C}$	1.41	0.01	0.23	0.037	0.006	0.158	Tempered for 30 min at 250 C and air-cooled.
65	189	L	1934	366- 509	2.0-5.0	$A_{T.\,300\,C}$	1.41	0.01	0.23	0.037	0.006	0.158	Tempered for 30 min at 300 C and air-cooled.
66	189	L	1934	370- 537	2.0-5.0	$A_{T.\,350\,C}$	1.41	0.01	0.23	0.037	0.006	0.158	Tempered for 30 min at 350 C and air-cooled.
67	189	L	1934	376- 539	2.0-5.0	$A_{T.\,400\,C}$	1.41	0.01	0.23	0.037	0.006	0.158	Tempered for 30 min at 400 C and air-cooled.
68	189	L	1934	377- 547	2.0-5.0	$A_{T.\,500\,C}$	1.41	0.01	0.23	0.037	0.006	0.158	Tempered for 30 min at 500 C and air-cooled.
69	189	L	1934	382- 538	2.0-5.0	$A_{T.\,600\,C}$	1.41	0.01	0.23	0.037	0.006	0.158	Tempered for 30 min at 600 C and air-cooled.
70	189	L	1934	370- 492	2.0-5.0	$A_{T.\,700\,C}$	1.41	0.01	0.23	0.037	0.006	0.158	Tempered for 30 min at 700 C and air-cooled.
71	189	L	1934	372- 544	2.0-5.0	A_{A}	1.41	0.01	0.23	0.037	0.006	0.158	Annealed at 775 C.
72	189	L	1934	353- 389	2.0-5.0	$B1_{Q}$	1.14		0.207	0.020	0.026	0.117	Water-quenched from 780 C.
73	189	L	1934	358- 387	2.0-5.0	$B1_{T.\,150\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 150 C and air-cooled.
74	189	L	1934	366- 421	2.0-5.0	$B1_{T.\,200\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 200 C and air-cooled.
75	189	L	1934	371- 469	2.0-5.0	$B1_{T.\,250\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 250 C and air-cooled.
76	189	L	19[illegible]	366- 520	2.0-5.0	$B1_{T.\,300\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 300 C and air-cooled.
77	189	L	19[illegible]	367- 540	2.0-5.0	$B1_{T.\,350\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 350 C and air-cooled.
78	189	L	1934	368- 545	2.0-5.0	$B1_{T.\,400\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 400 C and air-cooled.
79	189	L	1934	371- 541	2.0-5.0	$B1_{T.\,500\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 500 C and air-cooled.
80	189	L	1934	358- 534	2.0-5.0	$B1_{T.\,600\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 600 C and air-cooled.
81	189	L	1934	361- 530	2.0-5.0	$B1_{T.\,700\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 700 C and air-cooled.
82	189	L	1934	363- 536	2.0-5.0	$B1_{A}$	1.14		0.207	0.020	0.026	0.117	Annealed at 780 C.
83	189	L	1934	355- 388	2.0-5.0	$B2_{Q}$	1.14		0.207	0.020	0.026	0.117	Water-quenched from 840 C.
84	189	L	1934	359- 389	2.0-5.0	$B2_{T.\,150\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 150 C and air-cooled.
85	189	L	1934	361-421	2.0-5.0	$B2_{T.\,200\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 200 C and air-cooled.
86	189	L	1934	363- 469	2.0-5.0	$B2_{T.\,250\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 250 C and air-cooled.
87	189	L	1934	367- 502	2.0-5.0	$B2_{T.\,300\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 300 C and air-cooled.
88	189	L	1934	361- 534	2.0-5.0	$B2_{T.\,350\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 350 C and air-cooled.
89	189	L	1934	372- 532	2.0-5.0	$B2_{T.\,400\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 400 C and air-cooled.
90	189	L	1934	368- 535	2.0-5.0	$B2_{T.\,500\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 500 C and air-cooled.
91	189	L	1934	365- 543	2.0-5.0	$B2_{T.\,600\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 600 C and air-cooled.

SPECIFICATION TABLE NO. 322 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight per cent) C	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
92	189	L	1934	368- 540	2.0-5.0	$B2_{T.\,700}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 700 C and air-cooled.
93	189	L	1934	362- 389	2.0-5.0	$B3_{Q}$	1.14		0.207	0.020	0.026	0.117	Water-quenched from 900 C.
94	189	L	1934	363- 390	2.0-5.0	$B3_{T.\,150\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 150 C and air-cooled.
95	189	L	1934	370- 426	2.0-5.0	$B3_{T.\,200\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 200 C and air-cooled.
96	189	L	1934	360- 463	2.0-5.0	$B3_{T.\,250\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 250 C and air-cooled.
97	189	L	1934	361- 493	2.0-5.0	$B3_{T.\,300\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 300 C and air-cooled.
98	189	L	1934	372- 544	2.0-5.0	$B3_{T.\,350\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 350 C and air-cooled.
99	189	L	1934	366- 540	2.0-5.0	$B3_{T.\,400\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 400 C and air-cooled.
100	189	L	1934	364- 544	2.0-5.0	$B3_{T.\,500\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 500 C and air-cooled.
101	189	L	1934	368- 540	2.0-5.0	$B3_{T.\,600\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 600 C and air-cooled.
102	189	L	1934	371- 537	2.0-5.0	$B3_{T.\,700\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 700 C and air-cooled.
103	189	L	1934	360- 387	2.0-5.0	$B4_{Q}$	1.14		0.207	0.020	0.026	0.117	Water-quenched from 1000 C.
104	189	L	1934	368- 390	2.0-5.0	$B4_{T.\,150\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 150 C and air-cooled.
105	189	L	1934	358- 419	2.0-5.0	$B4_{T.\,200\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 200 C and air-cooled.
106	189	L	1934	363- 467	2.0-5.0	$B4_{T.\,250\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 250 C and air-cooled.
107	189	L	1934	366- 508	2.0-5.0	$B4_{T.\,300\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 300 C and air-cooled.
108	189	L	1934	373- 543	2.0-5.0	$B4_{T.\,350\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 350 C and air-cooled.
109	189	L	1934	365- 547	2.0-5.0	$B4_{T.\,400\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 400 C and air-cooled.
110	189	L	1934	367- 527	2.0-5.0	$B4_{T.\,500\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 500 C and air-cooled.
111	189	L	1934	368- 533	2.0-5.0	$B4_{T.\,600\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 600 C and air-cooled.
112	189	L	1934	372- 544	2.0-5.0	$B4_{T.\,700\,C}$	1.14		0.207	0.020	0.026	0.117	Tempered for 30 min at 700 C and air-cooled.
113	189	L	1934	362- 388	2.0-5.0	C_{Q}	0.931	0.038	0.157	0.014	0.007	0.109	Water-quenched from 790 C.
114	189	L	1934	361- 390	2.0-5.0	$C_{T.\,150\,C}$	0.931	0.038	0.157	0.014	0.007	0.109	Tempered for 30 min at 150 C and air-cooled.
115	189	L	1934	363- 415	2.0-5.0	$C_{T.\,200\,C}$	0.931	0.038	0.157	0.014	0.007	0.109	Tempered for 30 min at 200 C and air-cooled.
116	189	L	1934	368- 470	2.0-5.0	$C_{T.\,250\,C}$	0.931	0.038	0.157	0.014	0.007	0.109	Tempered for 30 min at 250 C and air-cooled.
117	189	L	1934	378- 506	2.0-5.0	$C_{T.\,300\,C}$	0.931	0.038	0.157	0.014	0.007	0.109	Tempered for 30 min at 300 C and air-cooled.
118	189	L	1934	364- 543	2.0-5.0	$C_{T.\,350\,C}$	0.931	0.038	0.157	0.014	0.007	0.109	Tempered for 30 min at 350 C and air-cooled.
119	189	L	1934	370- 497	2.0-5.0	$C_{T.\,400\,C}$	0.931	0.038	0.157	0.014	0.007	0.109	Tempered for 30 min at 400 C and air-cooled.
120	189	L	1934	368- 548	2.0-5.0	$C_{T.\,500\,C}$	0.931	0.038	0.157	0.014	0.007	0.109	Tempered for 30 min at 500 C and air-cooled.
121	189	L	1934	369- 543	2.0-5.0	$C_{T.\,600\,C}$	0.931	0.038	0.157	0.014	0.007	0.109	Tempered for 30 min at 600 C and air-cooled.

SPECIFICATION TABLE NO. 322 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Fe	C	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
									Composition (weight percent)					
122	189	L	1934	370- 551	2.0-5.0	$C_{T, 700 C}$		0.931	0.038	0.157	0.014	0.007	0.109	Tempered for 30 min at 700 C and air-cooled.
123	189	L	1934	377- 545	2.0-5.0	C_A		0.931	0.038	0.157	0.014	0.007	0.109	Annealed at 790 C.
124	71	L	1917	303-1199		12		0.64	0.09	0.27	0.010	0.028	0.06	Forged.
125	71	L	1917	303-1170		16		0.80	0.08	0.30	0.012	0.016	0.10	Forged.
126	71	L	1917	303-1159		20		1.02	0.05	0.36	0.013	0.014	0.08	Forged.
127	71	L	1917	303-1147		26		1.30	0.06	0.40	0.046	0.018	0.08	Forged.
128	71	L	1917	303-1048		30		1.50	0.05	0.36	0.020	0.020	0.05	Forged.
129	190	C, R	1946	273-1273		British steel; 7		0.80	0.070	0.32	0.008	0.009	0.13	0.13 Ni, 0.11 Cr, 0.021 As, <0.01 Mo, 0.004 Al; annealed at 860 C.
130	165	E	1919	303.2		1		0.206		0.11	0.05	0.04	0.06	
131	163	L	1936	303-1473		German steel; PDI		0.45		0.07	0.010	0.014	0.09	Annealed.
132	166	C	1939	273- 623		British steel; 7		0.80	0.070	0.32	0.008	0.009	0.13	0.13 Ni, 0.11 Cr, 0.021 As, <0.01 Mo, 0.004 Al; annealed at 800 C.
133	166	C	1939	273- 423		8		1.22	0.077	0.35	0.009	0.015	0.16	0.13 Ni, 0.11 Cr, 0.025 As, 0.01 Mo, 0.006 Al; annealed at 800 C.
134	191	~~L~~ R	1926	310, 320		A		0.50		0.32			0.24	
135	191	~~L~~ R	1926	313.4		B		0.71		0.18			0.24	
136	160	F	1938	373- 773		12		0.85		0.65				Nominal composition, annealed.
137	160	F	1938	373- 773		13		1.10		0.55				Nominal composition; annealed.
138	160	F	1938	373- 773		14		1.40		0.53				Nominal composition, annealed.
139	175	P	1936	303-1073		Carbon steel; 2		0.31	0.154	0.14	0.011	0.014	0.040	Annealed at 850 C for 2.5 hrs.
140	175	P	1936	303-1073		Carbon steel; 3		0.65	0.150	0.16	0.008	0.012	0.023	Annealed at 850 C for 2.5 hrs.
141	175	P	1936	303-1073		Carbon steel; 4		0.88	0.135	0.16	0.009	0.011	0.049	Annealed at 850 C for 2.5 hrs.
142	177	C	1936	298.2	10.0	Russian steel; U-9		0.91		0.35	0.030		0.35	Annealed.
143	192	L	1954	365- 632				1.13		0.43			0.4	1.43 FeO, 1.13 Fe_2O_3, porosity 19%; without heat treatment.
144	560	E	1953	350-814	±3.0			0.32		0.30			0.30	1.02 O; Sintered at 1150 C for 1 1/2 hrs; porosity 10.4%.
145	560	E	1953	342-711	±3.0			0.88		0.27			0.34	0.20 O; sintered at 1150 C for 1 1/2 hrs; porosity 9.5%.
146	560	E	1953	319-733	±3.0			0.88		0.27			0.34	0.22 O; sintered at 1150 C for 1 1/2 hrs; porosity 9.5%.
147	560	E	1953	358-750	±3.0			1.62		0.40			0.40	94.64 Fe; 0.4 Fe_2O_3; 0.36 FeO; sintered at 1150 C for 1 1/2 hrs; porosity 10.6%.
148	435	L	1900	291.2		FeWA14		0.105	0.05	0.06	0.03	0.015	0.015	
149	435	L	1900	291.2		FeWA 2		0.57	0.03	0.12	0.012	0.042	0.21	

SPECIFICATION TABLE NO. 322 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) C	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
150	435	L	1900	291.2		FeWA 3	0.99	0.035	0.12	0.005	0.025	0.06	
151	435	L	1900	291.2		FeWA 4	1.50	0.03	0.19	0.01	0.025	0.05	
152	561	C	1925	448.2			1.00		0.28			0.34	0.13 Ni.
153	561	C	1925	450.6		High C steel	1.28		0.07			0.12	
154	561	C	1925	449.0			0.05		0.04			0.01	
155	561	C	1925	445.7		Fish-plate	0.21	0.068	0.14	0.027	0.025	0.09	0.18 Ni and 0.06 Cr.
156	539	L	1938	329-1105		Carbon steel	1.01		0.47	0.02	0.01	0.16	0.08 Cr; annealed.
157	539	L	1938	337-787		Carbon steel	1.01		0.47	0.02	0.01	0.16	0.08 Cr; cooled in oil from 850 C.
158	562	L	1949	26-240		1095							Nominal Composition.
159	504	P	1961	295.2	±5.0	1020	0.18/ 0.23		0.30 0.60	0.04 Max	0.05 Max		Nominal Composition from Mark's handbook.

DATA TABLE NO. 322 THERMAL CONDUCTIVITY OF [IRON + CARBON + ΣX_i] ALLOYS ($C \le 2.00\%$) GROUP I

($X_i \le 0.20\%$ except Mn, P, S, Si $\le 0.60\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k
CURVE 1	
25.52	0.109
39.33	0.177
55.13	0.241
70.98	0.284
90.60	0.325
105.29	0.350
119.91	0.369
135.78	0.386
151.52	0.400
152.06	0.400
167.15	0.412
179.82	0.419
195.39	0.428
209.88	0.432
225.36	0.436
239.84	0.441
240.16	0.443
CURVE 2*	
373.20	0.458
473.20	0.435
573.20	0.413
673.20	0.390
773.20	0.367
818.00	0.352
CURVE 3*	
364.40	0.411
373.20	0.412
473.20	0.408
573.20	0.396
673.20	0.381
773.20	0.364
CURVE 4	
293.20	0.454
CURVE 5	
293.20	0.423
CURVE 6	
293.20	0.377

T	k
CURVE 7	
364.20	0.506
386.20	0.498
411.70	0.502
430.70	0.498
438.70	0.502
450.70	0.494
472.20	0.498
474.20	0.494
497.70	0.490
519.20	0.485
519.70	0.494
548.70	0.485
582.70	0.490
625.70	0.485
665.70	0.481
704.70	0.477
CURVE 8	
362.70	0.498
384.70	0.494
409.70	0.490
428.20	0.481
436.20	0.490
447.70	0.481
470.70	0.477
472.20	0.485
494.20	0.473
515.70	0.473
519.20	0.485
547.70	0.469
580.20	0.469
623.20	0.464
663.70	0.464
702.70	0.460
CURVE 9	
273.20	0.510
373.20	0.477
473.20	0.448
573.20	0.418
673.20	0.392
773.20	0.361

T	k
CURVE 10	
325.80	0.439
373.20	0.427
473.20	0.407
553.90	0.389
CURVE 11	
15.00	0.154
17.16	0.186
19.22	0.209
21.66	0.244
29.90	0.306
76.10	0.523
93.00	0.568
CURVE 12	
105.20	0.473
113.20	0.473
123.20	0.473
148.20	0.473
173.20	0.477
198.20	0.481
223.20	0.485
248.20	0.485
273.20	0.485
291.20	0.481
296.20	0.477
CURVE 13*	
313.20	0.473
313.20	0.444
CURVE 14*	
313.20	0.339
CURVE 15*	
313.20	0.460
CURVE 16*	
313.20	0.464

T	k
CURVE 17*	
313.20	0.272
313.20	0.312
CURVE 18	
313.20	0.402
CURVE 19*	
313.20	0.414
CURVE 20	
313.20	0.305
313.20	0.225
CURVE 21*	
313.20	0.510
CURVE 22*	
313.20	0.510
CURVE 23*	
313.20	0.502
CURVE 24*	
313.20	0.531
313.20	0.511
CURVE 25*	
313.20	0.510
CURVE 26	
313.20	0.551
CURVE 27*	
313.20	0.521

T	k
CURVE 28*	
303.20	0.418
CURVE 29*	
303.20	0.411
CURVE 30	
303.20	0.457
CURVE 31*	
303.20	0.422
CURVE 32*	
303.20	0.418
CURVE 33*	
303.20	0.410
CURVE 34*	
303.20	0.389
CURVE 35*	
303.20	0.439
CURVE 36*	
303.20	0.431
CURVE 37*	
303.20	0.418
CURVE 38*	
303.20	0.414
CURVE 39*	
303.20	0.393

T	k
CURVE 40	
303.20	0.352
CURVE 41*	
303.20	0.423
CURVE 42*	
303.20	0.423
CURVE 43*	
303.20	0.385
CURVE 44*	
303.20	0.393
CURVE 45*	
303.20	0.398
CURVE 46	
303.20	0.289
CURVE 47*	
303.20	0.431
CURVE 48*	
303.20	0.381
CURVE 49*	
303.20	0.318
CURVE 50*	
303.20	0.360
CURVE 51*	
303.20	0.356

T	k
CURVE 52*	
303.20	0.322
CURVE 53*	
303.20	0.360
CURVE 54*	
303.20	0.347
CURVE 55*	
303.20	0.297
CURVE 56	
307.20	0.447
CURVE 57*	
307.20	0.417
CURVE 58	
307.20	0.416
CURVE 59*	
307.20	0.387
CURVE 60	
307.20	0.384
CURVE 61	
355.70	0.305
374.20	0.310
390.20	0.318
CURVE 62*	
360.70	0.322
376.70	0.322
389.70	0.326

T	k
CURVE 63*	
366.20	0.331
401.70	0.339
427.20	0.335
CURVE 64*	
364.20	0.368
395.70	0.364
424.70	0.372
451.20	0.368
467.70	0.364
CURVE 65*	
365.70	0.377
393.20	0.385
427.20	0.381
451.70	0.385
487.20	0.377
508.70	0.381
CURVE 66*	
369.20	0.381
390.70	0.385
432.20	0.389
453.70	0.385
482.20	0.381
516.70	0.389
537.20	0.389
CURVE 67*	
376.20	0.398
393.20	0.385
428.70	0.389
455.70	0.395
491.20	0.389
518.70	0.385
539.20	0.381

*Not shown on plot

DATA TABLE NO. 322 (continued)

CURVE 68*

T	k
376.70	0.393
422.70	0.393
435.20	0.402
456.20	0.398
489.70	0.393
518.20	0.398
546.70	0.389

CURVE 69*

T	k
381.70	0.398
409.20	0.402
436.20	0.393
463.70	0.402
489.20	0.398
512.20	0.402
538.20	0.393

CURVE 70*

T	k
369.70	0.406
395.70	0.398
431.20	0.406
452.20	0.410
476.20	0.402
508.20	0.402
491.70	0.398

CURVE 71*

T	k
371.70	0.402
391.20	0.410
429.20	0.402
462.20	0.406
491.20	0.410
516.70	0.402
543.70	0.398

CURVE 72

T	k
357.70	0.322
374.70	0.322
389.20	0.326

CURVE 73*

T	k
357.70	0.335
375.20	0.339
387.20	0.339

CURVE 74*

T	k
365.70	0.352
402.20	0.347
420.70	0.352

CURVE 75*

T	k
370.70	0.381
400.70	0.385
431.20	0.381
454.20	0.385
469.20	0.377

CURVE 76*

T	k
366.20	0.393
393.70	0.398
424.70	0.398
453.70	0.389
479.20	0.402
520.20	0.393

CURVE 77*

T	k
367.20	0.398
401.20	0.383
428.70	0.393
442.20	0.398
474.20	0.393
506.70	0.389
540.20	0.393

CURVE 78*

T	k
368.20	0.414
397.70	0.423
428.20	0.414
461.20	0.414
486.70	0.418

CURVE 78 (cont.)

T	k
521.20	0.414
544.70	0.406

CURVE 79*

T	k
370.70	0.414
392.20	0.418
410.70	0.410
445.20	0.410
474.20	0.406
511.20	0.414
540.70	0.410

CURVE 80*

T	k
358.20	0.427
391.20	0.423
419.20	0.423
457.70	0.414
473.70	0.423
515.20	0.410
534.20	0.414

CURVE 81*

T	k
360.70	0.431
400.70	0.427
432.70	0.423
450.20	0.427
482.70	0.423
509.20	0.431
529.70	0.427

CURVE 82*

T	k
363.20	0.431
396.20	0.423
428.20	0.431
452.70	0.427
475.70	0.423
508.20	0.427
536.20	0.416

CURVE 83*

T	k
355.70	0.297
374.20	0.297
388.20	0.305

CURVE 84*

T	k
359.20	0.318
374.70	0.314
389.20	0.318

CURVE 85*

T	k
361.70	0.339
391.20	0.335
420.70	0.343

CURVE 86*

T	k
363.70	0.385
387.20	0.381
413.20	0.389
439.20	0.385
469.20	0.385

CURVE 87*

T	k
367.20	0.398
395.70	0.406
427.70	0.402
457.20	0.402
479.70	0.398
501.70	0.398

CURVE 88*

T	k
361.70	0.402
399.70	0.398
421.20	0.406
451.20	0.402
474.20	0.406
500.20	0.396
534.20	0.402

CURVE 89*

T	k
372.20	0.423
399.40	0.431
425.20	0.423
449.20	0.423
478.20	0.427
500.70	0.423
532.20	0.414

CURVE 90*

T	k
368.20	0.423
397.70	0.427
427.70	0.427
452.20	0.431
477.70	0.423
505.70	0.427
535.20	0.423

CURVE 91*

T	k
365.70	0.435
399.20	0.427
429.20	0.431
460.20	0.435
494.70	0.427
516.20	0.435
543.20	0.427

CURVE 92*

T	k
368.20	0.435
395.20	0.427
419.20	0.431
445.20	0.423
481.20	0.427
511.70	0.431
540.20	0.418

CURVE 93*

T	k
362.70	0.259
374.70	0.264
389.20	0.272

CURVE 94*

T	k
363.70	0.285
376.70	0.285
389.70	0.289

CURVE 95*

T	k
370.20	0.297
390.20	0.301
426.20	0.301

CURVE 96*

T	k
360.70	0.364
391.70	0.368
422.20	0.364
446.70	0.360
462.70	0.368

CURVE 97*

T	k
361.20	0.398
385.50	0.402
415.20	0.393
445.70	0.389
464.70	0.402
493.20	0.396

CURVE 98*

T	k
372.20	0.402
394.20	0.398
419.70	0.393
453.20	0.398
477.70	0.389
515.20	0.398
544.20	0.402

CURVE 99

T	k
366.20	0.398
391.70	0.393
410.70	0.393
447.20	0.389
476.70	0.393

CURVE 99 (cont.)

T	k
495.70	0.393
540.20	0.381

CURVE 100*

T	k
364.70	0.427
389.70	0.423
422.20	0.414
446.20	0.410
470.70	0.414
503.70	0.414
543.70	0.406

CURVE 101*

T	k
368.70	0.435
394.70	0.431
429.20	0.423
451.20	0.427
477.20	0.418
506.20	0.427
539.70	0.423

CURVE 102*

T	k
371.20	0.427
394.20	0.423
431.70	0.423
456.20	0.418
474.20	0.427
509.20	0.423
536.70	0.410

CURVE 103

T	k
360.20	0.247
377.20	0.251
386.70	0.255

CURVE 104

T	k
368.20	0.272
375.70	0.268
390.20	0.272

CURVE 105

T	k
358.70	0.285
395.70	0.289
418.70	0.285

CURVE 106*

T	k
363.70	0.285
392.70	0.381
418.70	0.377
452.70	0.372
467.20	0.377

CURVE 107*

T	k
366.20	0.393
402.20	0.389
415.70	0.398
444.20	0.389
479.20	0.393
508.20	0.385

CURVE 108*

T	k
373.70	0.398
400.20	0.389
416.70	0.398
456.20	0.393
492.70	0.398
514.70	0.389
543.20	0.381

CURVE 109*

T	k
365.20	0.402
397.70	0.398
416.70	0.396
442.70	0.402
479.70	0.398
503.70	0.393
546.70	0.385

*Not shown on plot

DATA TABLE NO. 322 (continued)

T	k
CURVE 110*	
367.20	0.427
391.20	0.423
428.20	0.427
451.20	0.414
480.20	0.423
506.20	0.414
527.20	0.427
CURVE 111*	
368.20	0.427
388.70	0.414
420.20	0.423
444.70	0.414
473.20	0.410
507.70	0.414
532.70	0.410
CURVE 112*	
372.20	0.427
404.70	0.427
431.70	0.423
452.20	0.414
484.70	0.418
516.20	0.423
544.20	0.410
CURVE 113*	
362.70	0.326
373.70	0.326
388.20	0.335
CURVE 114	
361.20	0.343
372.70	0.347
389.70	0.347
CURVE 115*	
363.20	0.356
379.20	0.352
414.70	0.356
CURVE 116*	
368.20	0.398
397.20	0.402
428.70	0.406
453.20	0.406
470.20	0.402
CURVE 117*	
378.20	0.410
400.70	0.406
429.20	0.402
451.20	0.402
481.70	0.406
506.20	0.402
CURVE 118*	
364.70	0.410
396.20	0.414
428.20	0.410
455.20	0.410
487.20	0.414
511.70	0.410
543.20	0.402
CURVE 119*	
370.20	0.435
401.70	0.431
432.20	0.427
459.20	0.423
495.20	0.427
520.70	0.423
496.70	0.427
CURVE 120*	
368.20	0.439
399.70	0.427
426.70	0.431
451.20	0.435
478.70	0.427
507.70	0.431
548.20	0.423
CURVE 121*	
369.70	0.444
393.70	0.439
425.70	0.439
458.20	0.431
485.70	0.435
509.70	0.427
543.20	0.431
CURVE 122	
369.70	0.448
411.20	0.444
439.20	0.435
464.70	0.439
499.20	0.431
530.70	0.435
550.70	0.427
CURVE 123*	
377.20	0.448
416.20	0.439
442.20	0.444
475.20	0.444
500.70	0.439
525.20	0.444
544.70	0.435
CURVE 124*	
303.20	0.439
391.20	0.439
420.20	0.439
469.20	0.435
521.20	0.431
527.20	0.414
641.20	0.410
690.20	0.410
796.20	0.368
851.20	0.356
912.20	0.360
967.20	0.385
999.20	0.297
1044.20	0.289
CURVE 124 (cont.)	
1100.20	0.305
1134.20	0.289
1199.20	0.318
CURVE 125*	
303.20	0.423
363.20	0.435
452.20	0.423
515.20	0.423
593.20	0.423
642.20	0.398
689.20	0.402
743.20	0.393
781.20	0.385
816.20	0.364
902.20	0.343
954.20	0.418
1030.20	0.305
1108.20	0.314
1170.20	0.322
CURVE 126*	
303.20	0.431
389.20	0.423
418.20	0.423
470.20	0.431
527.20	0.431
582.20	0.414
633.20	0.418
680.20	0.414
752.20	0.402
817.20	0.398
898.20	0.372
960.20	0.423
1031.20	0.310
1055.20	0.326
1088.20	0.322
1159.20	0.322
CURVE 127*	
303.20	0.360
383.20	0.360
CURVE 127 (cont.)	
407.20	0.368
460.20	0.368
487.20	0.364
541.20	0.368
595.20	0.368
638.20	0.343
693.20	0.356
728.20	0.356
760.20	0.343
803.20	0.326
863.20	0.318
910.20	0.310
973.20	0.414
1022.20	0.276
1102.20	0.268
1147.20	0.280
CURVE 128	
303.20	0.360
361.20	0.360
402.20	0.360
437.20	0.364
492.20	0.364
576.20	0.356
650.20	0.347
691.20	0.347
719.20	0.343
753.20	0.339
800.20	0.310
904.20	0.310
972.20	0.372
1030.20	0.272
1048.20	0.276
CURVE 129	
273.20	0.498
323.20	0.494
373.20	0.483
423.20	0.469
473.20	0.452
523.20	0.431
573.20	0.414
623.20	0.398
CURVE 129 (cont.)	
673.20	0.381
723.20	0.366
773.20	0.354
823.20	0.341
873.20	0.299
923.20	0.316
973.20	0.303
993.20	0.297
1013.20	0.239
1023.20	0.239
1073.20	0.243
1123.20	0.247
1173.20	0.251
1223.20	0.259
1273.20	0.268
CURVE 130	
303.20	0.543
CURVE 131	
303.20	0.406*
323.20	0.406*
373.20	0.406*
473.20	0.406*
573.20	0.402*
673.20	0.377*
773.20	0.343
873.20	0.314
973.20	0.289
1073.20	0.264
1173.20	0.264
1273.20	0.272
1373.20	0.276
1473.20	0.280
CURVE 132*	
273.20	0.498
323.20	0.494
373.20	0.483
423.20	0.469
473.20	0.451
523.20	0.431
CURVE 132 (cont.)	
573.20	0.414
623.20	0.401
CURVE 133*	
273.20	0.451
323.20	0.448
373.20	0.448
423.20	0.448
CURVE 134*	
310.10	0.552
320.10	0.548
CURVE 135*	
313.40	0.519
CURVE 136	
373.20	0.669
473.20	0.510
573.20	0.427
673.20	0.366
773.20	0.291
CURVE 137*	
373.20	0.653
473.20	0.498
573.20	0.418
673.20	0.335
773.20	0.272
CURVE 138	
373.20	0.636
473.20	0.496
573.20	0.402
673.20	0.318
773.20	0.251
CURVE 139	
303.20	0.695
323.20	0.661
361.20	0.590
373.20	0.573
422.20	0.498
473.20	0.435
499.20	0.410
573.20	0.372
612.20	0.339
673.20	0.265
723.20	0.217
773.20	0.211
850.20	0.206
873.20	0.200
941.20	0.196
973.20	0.194
1073.20	0.192
CURVE 140	
303.20	0.647
323.20	0.606
360.20	0.537
373.20	0.517
416.20	0.451
473.20	0.390
491.20	0.375
573.20	0.331
599.20	0.312
673.20	0.238
730.20	0.193
773.20	0.193
829.20	0.193
873.20	0.187
949.20	0.187
973.20	0.187
1073.20	0.188
CURVE 141	
303.20	0.590
323.20	0.561
353.20	0.515
373.20	0.477
408.20	0.427

*Not shown on plot

DATA TABLE NO. 322 (continued)

T	k
CURVE 141 (cont.)	
473.2	0.357
507.2	0.334
573.2	0.308
589.2	0.299
673.2	0.226
719.2	0.194
773.2	0.187
807.2	0.185
873.2	0.185
931.2	0.186
973.2	0.187
1073.2	0.190
CURVE 142*	
298.2	0.452
CURVE 143	
365.0	0.351
400.0	0.339
448.3	0.326
484.4	0.318
521.1	0.310
594.1	0.229
631.8	0.245
CURVE 144*	
349.7	0.285
388.5	0.276
429.3	0.276
475.0	0.272
544.7	0.259
648.7	0.234
700.2	0.230
738.4	0.226
814.3	0.209

T	k
CURVE 145*	
341.5	0.289
380.6	0.318
456.0	0.343
517.1	0.347
533.9	0.347
606.8	0.351
657.6	0.351
711.2	0.343
CURVE 146*	
318.6	0.310
373.2	0.318
424.6	0.351
489.0	0.351
530.5	0.351
603.2	0.351
695.2	0.356
733.2	0.347
CURVE 147*	
358.4	0.301
393.4	0.297
450.0	0.289
519.2	0.276
584.1	0.268
626.6	0.255
750.0	0.238
CURVE 148	
291.2	0.715
CURVE 149	
291.2	0.519
CURVE 150*	
291.2	0.515

T	k
CURVE 151*	
291.2	0.498
CURVE 152*	
448.2	0.531
CURVE 153	
450.6	0.550
CURVE 154	
449.0	0.777
CURVE 155	
445.7	0.798
CURVE 156*	
329.2	0.488
376.2	0.477
457.2	0.457
530.2	0.437
635.2	0.411
698.2	0.386
775.2	0.368
845.2	0.343
908.2	0.336
965.2	0.331
1013.2	0.497
1056.2	0.336
1105.2	0.323
CURVE 157*	
337.2	0.454
384.2	0.440
449.2	0.439
568.2	0.412
674.2	0.382
787.2	0.377

T	k
CURVE 158*	
25.5	0.109
39.3	0.178
55.1	0.240
71.0	0.285
90.5	0.326
105.2	0.351
119.8	0.369
135.7	0.386
151.4	0.400
152.0	0.400
167.1	0.411
179.7	0.420
195.2	0.429
211.7	0.432
225.2	0.436
239.8	0.439
240.1	0.441
CURVE 159*	
295.2	0.502

*Not shown on plot

FIGURE SHOWS ONLY 15 OF THE CURVES REPORTED IN TABLE

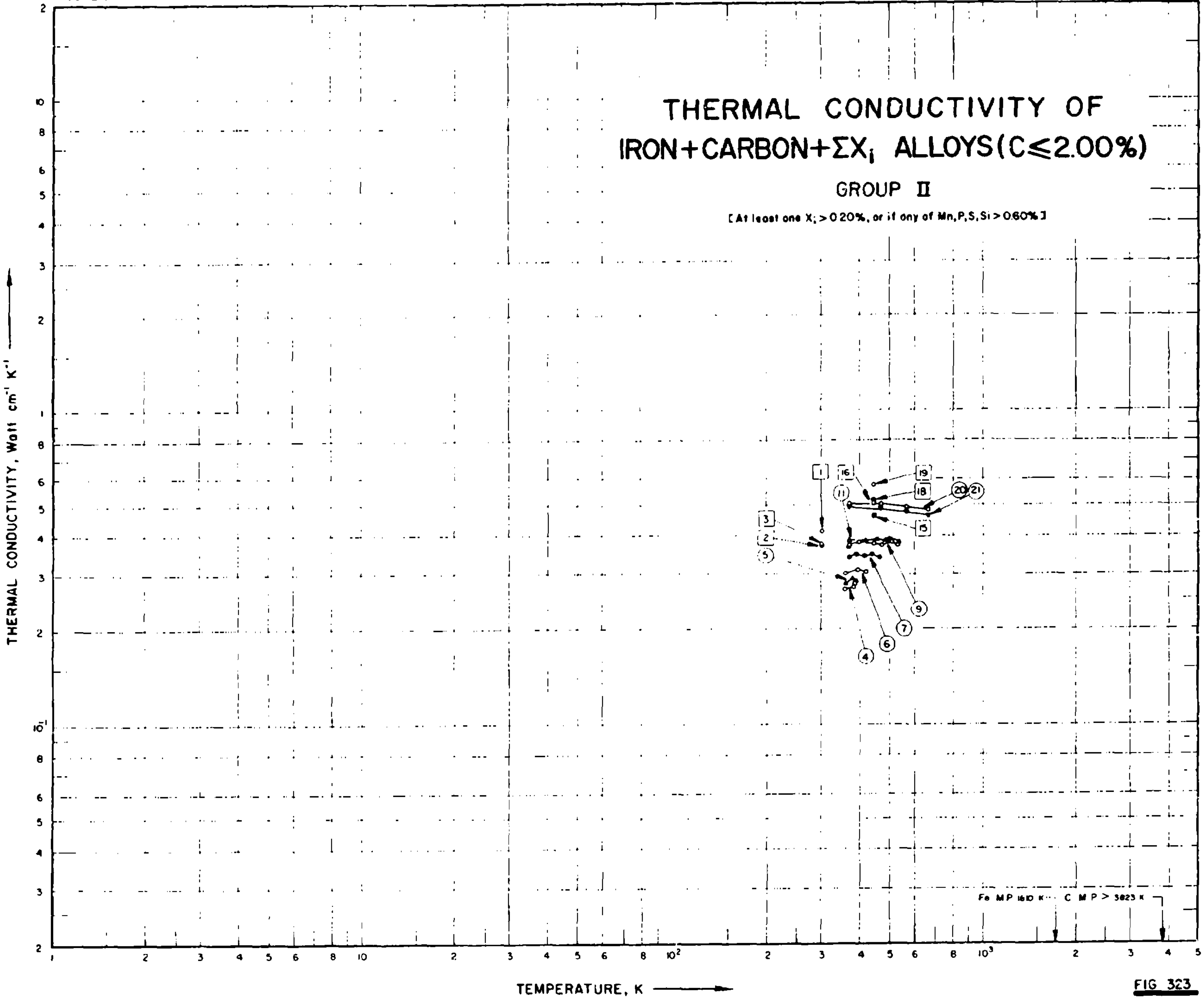


FIG 323

SPECIFICATION TABLE NO. 323 THERMAL CONDUCTIVITY OF [IRON + CARBON + ΣX_i] ALLOYS (C ≤ 2.00%) GROUP II

(At least one X_i > 0.20% or if any of Mn, P, S, Si > 0.60%)

[For Data Reported in Figure and Table No. 323]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	C	Cr	Mn	P	S	Si	Composition (continued), Specifications and Remarks
								Composition (weight per cent)					
1	176	E	~1920	303		2a	0.6	0.5					Annealed at 900 C and slowly cooled.
2	176	E	1920	303		2b	0.6	0.5					Annealed at 1100 C and quickly cooled.
3	188	E	1919	303		2b	0.6						0.5 W; annealed at 900 C and slowly cooled.
4	189	L	1934	360-389	2.0-5.0	Oil-hardening non-deforming steel S_Q	0.789	0.645	0.592	0.022	0.020	0.177	Oil-quenched from 790 C.
5	189	L	1934	363-391	2.0-5.0	Oil-hardening non-deforming steel $S_{T, 150\ C}$	0.789	0.645	0.592	0.022	0.020	0.177	Tempered for 30 min at 150 C and air-cooled.
6	189	L	1934	360-421	2.0-5.0	Oil-hardening non-deforming steel $S_{T, 200\ C}$	0.789	0.645	0.592	0.022	0.029	0.177	Tempered for 30 min at 200 C and air-cooled.
7	189	L	1934	371-466	2.0-5.0	Oil-hardening non-deforming steel $S_{T, 250\ C}$	0.789	0.645	0.592	0.022	0.020	0.177	Tempered for 30 min at 250 C and air-cooled.
8	189	L	1934	367-499	2.0-5.0	Oil-hardening non-deforming steel $S_{T, 300\ C}$	0.789	0.645	0.592	0.022	0.020	0.177	Tempered for 30 min at 300 C and air-cooled.
9	189	L	1934	370-532	2.0-5.0	Oil-hardening non-deforming steel $S_{T, 350\ C}$	0.789	0.645	0.592	0.022	0.020	0.177	Tempered for 30 min at 350 C and air-cooled.
10	189	L	1934	371-548	2.0-5.0	Oil-hardening non-deforming steel $S_{T, 400\ C}$	0.789	0.645	0.592	0.022	0.020	0.177	Tempered for 30 min at 400 C and air-cooled.
11	189	L	1934	372-540	2.0-5.0	Oil-hardening non-deforming steel $S_{T, 500\ C}$	0.789	0.645	0.592	0.022	0.020	0.177	Tempered for 30 min at 500 C and air-cooled.
12	189	L	1934	371-535	2.0-5.0	Oil-hardening non-deforming steel $S_{T, 600\ C}$	0.789	0.645	0.592	0.022	0.020	0.177	Tempered for 30 min at 600 C and air-cooled.
13	189	L	1934	371-538	2.0-5.0	Oil-hardening non-deforming steel $S_{T, 700\ C}$	0.789	0.645	0.592	0.022	0.020	0.177	Tempered for 30 min at 700 C and air-cooled.
14	189	L	1934	371-544	2.0-5.0	Oil-hardening non-deforming steel S_A	0.789	0.645	0.592	0.022	0.020	0.177	Annealed at 730 C.

SPECIFICATION TABLE NO. 323 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) C	Cr	Mn	P	S	Si	Composition (continued), Specifications and Remarks
15	561	C	1925	445			0.62		0.22			0.29	0.27 Ni
16	561	C	1925	450			1.55		0.24			0.35	0.23 Ni.
17	561	C	1925	440		Carbon steel	0.95		0.22			0.24	0.39 Ni; quenched in NaOH solution from 850 C.
18	561	C	1925	441		Carbon steel	0.95		0.22			0.24	0.39 Ni, tempered at 450 C.
19	561	C	1925	447		Carbon steel	0.95		0.22			0.24	0.39 Ni; annealed at 850 C.
20	976	L	1933	373-673		Soft steel	0.92		0.56	0.032	0.039	0.18	No details reported.
21	976	L	1933	373-673		Soft steel	1.09		0.46	0.034	0.023	0.06	No details reported.

DATA TABLE NO. 323 THERMAL CONDUCTIVITY OF [IRON + CARBON + ΣX_i] ALLOYS (C < 2.00%) GROUP II

(At least one X_i > 0.20% or if any of Mn, P, S, Si > 0.60%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k	T	k	T	k
CURVE 1		CURVE 9		CURVE 13 (cont.)*		CURVE 21 (cont.)	
303.20	0.416	369.70	0.368	488.70	0.389	473.2	0.485
		399.70	0.381	506.20	0.385	573.2	0.473
CURVE 2		371.70	0.372	538.20	0.393	673.2	0.464
		450.20	0.377				
303.20	0.371	474.70	0.372	CURVE 14*			
		511.70	0.381				
CURVE 3		532.20	0.372	370.70	0.381		
				396.70	0.385		
303.20	0.374	CURVE 10*		425.20	0.389		
				448.70	0.389		
CURVE 4		370.70	0.368	483.20	0.381		
		393.20	0.377	517.70	0.385		
359.70	0.268	410.70	0.372	543.70	0.389		
374.70	0.272	449.70	0.377				
389.20	0.280	476.70	0.368	CURVE 15			
		518.20	0.372				
CURVE 5		547.70	0.364	444.8	0.464		
363.20	0.280	CURVE 11		CURVE 16			
381.20	0.289						
391.20	0.285	371.70	0.385	449.7	0.510		
		500.20	0.389				
CURVE 6		422.20	0.385	CURVE 17*			
		456.70	0.389				
359.70	0.301	488.20	0.385	446.3	0.397		
394.70	0.310	505.20	0.389				
420.70	0.305	540.20	0.381	CURVE 18			
CURVE 7		CURVE 12*		440.7	0.518		
370.70	0.339	371.20	0.385	CURVE 19			
391.20	0.347	402.70	0.385				
416.70	0.343	428.20	0.385	446.6	0.575		
439.70	0.347	451.70	0.381				
466.20	0.339	477.70	0.385	CURVE 20			
		503.70	0.381				
CURVE 8*		535.20	0.372	373.2	0.502		
				473.2	0.498		
366.70	0.372	CURVE 13*		573.2	0.490		
394.20	0.385			673.2	0.481		
424.20	0.377	371.20	0.385				
459.20	0.372	401.70	0.399	CURVE 21			
482.70	0.377	434.20	0.389				
498.70	0.381	451.70	0.393	373.2	0.494		

* Not shown on plot

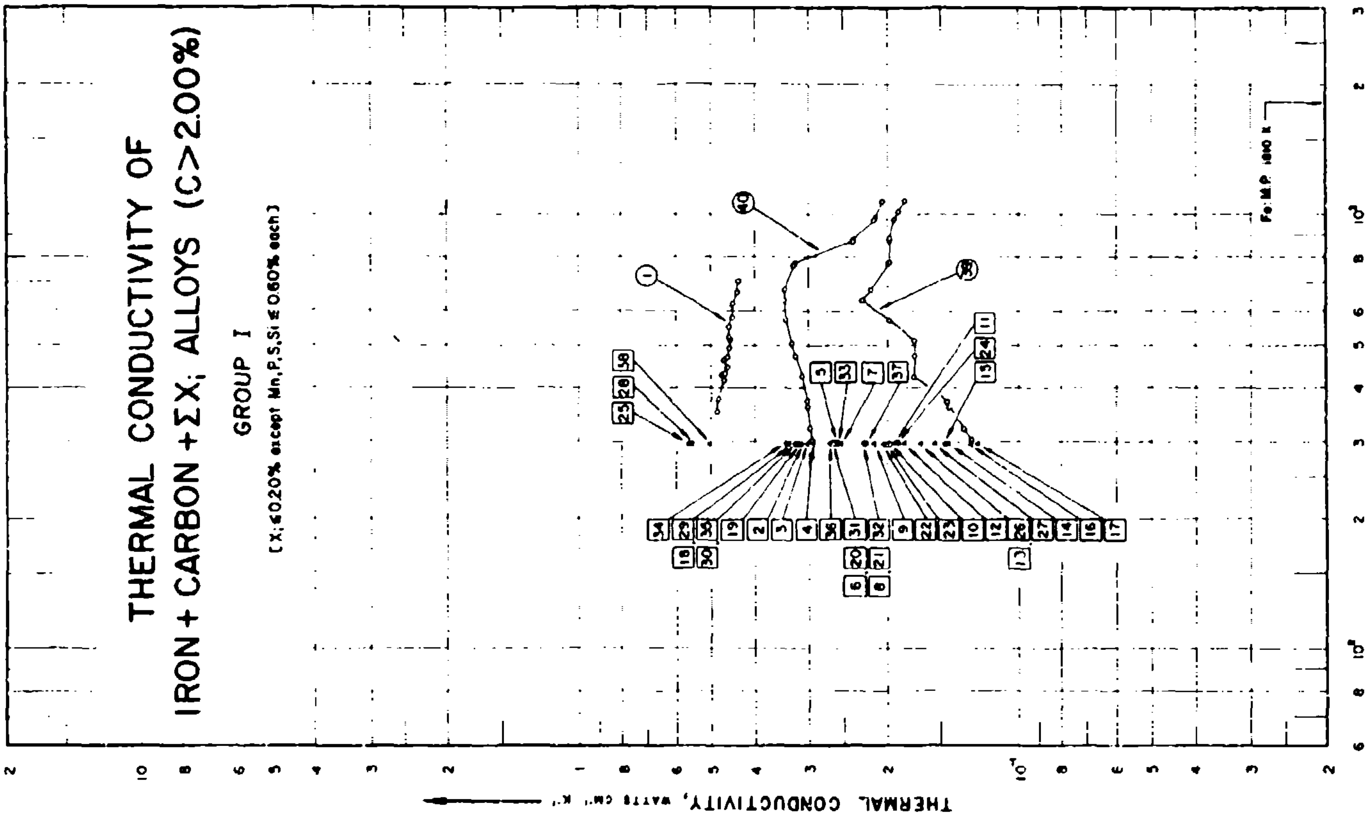

THERMAL CONDUCTIVITY OF
IRON + CARBON + ΣXi ALLOYS (C>2.00%)
GROUP I
[Xi ≤ 0.20% except Mn,P,S,Si ≤ 0.60% each]
Fe: M.P. 1810 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹

FIG 324

SPECIFICATION TABLE NO. 324 THERMAL CONDUCTIVITY OF [IRON + CARBON + ΣX_i] ALLOYS (C > 2.00%) GROUP I

(X_i < 0.20% except Mn, P, S, Si < 0.60% each)

[For Data Reported in Figure and Table No. 324]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	C	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
							Composition (weight per cent)						
1	31	L	1933	354-704	2.0	WM	2.80		0.10	0.061	0.093	0.39	[0.76 graphitic carbon, 2.04 combined carbon].
2	172	E	1927	298		Cast iron; 1a	2.41	Trace	0.05	0.036	0.093	0.12	As cast.
3	172	E	1927	298		2a	2.53	Trace	0.02	0.014	0.029	0.05	As cast.
4	172	E	1927	298		3a	2.67	Trace	0.02	0.033	0.048	0.11	As cast.
5	172	E	1927	298		4a	3.12	Trace	0.05	0.024	0.055	0.06	As cast.
6	172	E	1927	298		5a	3.14	Trace	0.03	0.019	0.030	0.01	As cast.
7	172	E	1927	298		6a	3.17	Trace	0.08	0.040	0.057	0.21	As cast.
8	172	E	1927	298		7a	3.53	Trace	0.05	0.009	0.052	0.04	As cast.
9	172	E	1927	298		8a	3.64	Trace	0.04	0.021	0.024	0.16	As cast.
10	172	E	1927	298		9a	3.93	Trace	0.04	0.020	0.049	0.15	As cast.
11	172	E	1927	298		10a	3.96	Trace	0.06	0.011	0.021	0.20	As cast.
12	172	E	1927	298		11a	4.13	Trace	0.03	0.017	0.023	0.10	As cast.
13	172	E	1927	298		12a	4.26	Trace	0.03	0.019	0.020	0.10	As cast.
14	172	E	1927	298		13a	4.35	Trace	0.08	0.022	0.023	0.35	As cast.
15	172	E	1927	298		14a	4.40	Trace	0.03	0.019	0.075	0.34	As cast.
16	172	E	1927	298		15a	4.61	Trace	0.03	0.017	0.040	0.37	As cast.
17	172	E	1927	298		16a	4.63	Trace	0.08	0.020	0.074	0.54	As cast.
18	172	E	1927	298		1b	2.41	Trace	0.05	0.036	0.093	0.12	Cast; annealed at 1000 C for 2 hrs.
19	172	E	1927	298		3b	2.67	Trace	0.02	0.033	0.048	0.11	Cast; annealed at 1000 C for 2 hrs.
20	172	E	1927	298		6b	3.17	Trace	0.08	0.040	0.057	0.21	Cast; annealed at 1000 C for 2 hrs.
21	172	E	1927	298		8b	3.64	Trace	0.04	0.021	0.024	0.16	Cast; annealed at 1000 C for 2 hrs.
22	172	E	1927	298		10b	3.96	Trace	0.06	0.011	0.021	0.20	Small graphite appeared in granular form; annealed at 1000 C for 2 hrs.
23	172	E	1927	298		11b	4.13	Trace	0.03	0.017	0.023	0.10	Annealed for 3 hrs at 650 C.
24	172	E	1927	298		12b	4.26	Trace	0.03	0.019	0.020	0.10	Annealed for 3 hrs at 650 C.
25	172	E	1927	298		13b	4.35	Trace	0.08	0.022	0.023	0.35	3.89 graphite in granular form; annealed at 1000 C for 2 hrs.
26	172	E	1927	298		14b	4.40	Trace	0.03	0.019	0.075	0.34	Annealed for 3 hrs at 650 C.
27	172	E	1927	298		15b	4.61	Trace	0.03	0.017	0.040	0.37	Annealed for 3 hrs at 650 C.
28	172	E	1927	298		16b	4.63	Trace	0.08	0.020	0.074	0.54	4.55 graphite in granular form; annealed at 1000 C for 2 hrs.
29	172	E	1927	298		1c	2.41	Trace	0.05	0.036	0.093	0.12	Annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs.

SPECIFICATION TABLE NO. 324 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	C	Composition (weight per cent) Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
30	172	E	1927	298		Cast iron; 3c	2.67	Trace	0.02	0.033	0.048	0.11	Annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs.
31	172	E	1927	298		6c	3.17	Trace	0.08	0.040	0.057	0.21	Annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs.
32	172	E	1927	298		8c	3.64	Trace	0.04	0.021	0.024	0.16	Annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs.
33	172	E	1927	298		10c	3.96	Trace	0.06	0.011	0.021	0.20	1.10 graphite in granular form; annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs.
34	172	E	1927	298		1d	2.41	Trace	0.05	0.036	0.093	0.12	Annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs and third at 1090 C for 2 hrs.
35	172	E	1927	298		3d	2.67	Trace	0.02	0.033	0.048	0.11	Annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs and third at 1090 C for 2 hrs.
36	172	E	1927	298		6d	3.17	Trace	0.08	0.040	0.057	0.21	Annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs and third at 1090 C for 2 hrs.
37	172	E	1927	298		8d	3.64	Trace	0.04	0.021	0.024	0.16	Annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs and third at 1090 C for 2 hrs.
38	172	E	1927	298		10d	3.96	Trace	0.06	0.011	0.021	0.20	3.02 graphite in granular form; annealed first at 1000 C for 2 hrs and second at 1000 C for 4 hrs and third at 1090 C for 2 hrs.
39	175	P	1936	303-1073		White cast iron; 1	3.02	0.089	0.53	0.567	0.074	0.57	
40	175	P	1936	303-1073		Grey cast iron; 4	3.08	0.136	0.44	0.540	0.074	0.58	

DATA TABLE NO. 324 THERMAL CONDUCTIVITY OF [IRON + CARBON + ΣX_i] ALLOYS (C > 2.00%) GROUP I

(X_i ≤ 0.20% except Mn, P, S, Si ≤ 0.60% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

	T	k
CURVE 1	353.70	0.485
	376.70	0.481
	418.20	0.469
	429.70	0.473
	431.70	0.469
	447.20	0.460
	464.70	0.469
	472.20	0.460
	496.20	0.456
	515.70	0.452
	527.70	0.456
	552.20	0.456
	581.20	0.448
	625.70	0.448
	666.70	0.439
	703.70	0.435
CURVE 2	298.20	0.319
CURVE 3	298.20	0.303
CURVE 4	298.20	0.294
CURVE 5	298.20	0.260
CURVE 6	298.20	0.264
CURVE 7	298.20	0.254
CURVE 8	298.20	0.226
CURVE 9	298.20	0.215
CURVE 10	298.20	0.196
CURVE 11	298.20	0.191
CURVE 12	298.20	0.182
CURVE 13	298.20	0.167
CURVE 14	298.20	0.145
CURVE 15	298.20	0.146
CURVE 16	298.20	0.129
CURVE 17	298.20	0.124
CURVE 18	298.20	0.335
CURVE 19	298.20	0.318
CURVE 20	298.20	0.265
CURVE 21	298.20	0.226
CURVE 22	298.20	0.205
CURVE 23	298.20	0.200
CURVE 24	298.20	0.189
CURVE 25	298.20	0.563
CURVE 26	298.20	0.167
CURVE 27	298.20	0.155
CURVE 28	298.20	0.557
CURVE 29	298.20	0.334
CURVE 30	298.20	0.321
CURVE 31	298.20	0.265
CURVE 32	298.20	0.226
CURVE 33	298.20	0.256
CURVE 34	298.20	0.339
CURVE 35	298.20	0.322
CURVE 36	298.20	0.268
CURVE 37	298.20	0.225
CURVE 38	298.20	0.503
CURVE 39	303.20	0.128
	323.20	0.133
	362.20	0.143
	373.20	0.145
	425.20	0.173
	473.20	0.172
	512.20	0.172
	573.20	0.197
	636.20	0.228
	673.20	0.218
	773.20	0.199
	775.20	0.198
	873.20	0.198
	884.20	0.198
	973.20	0.192
	1015.20	0.188
	1073.20	0.181
CURVE 40	303.20	0.295
	323.20	0.297
	361.20	0.300
	373.20	0.301
	427.20	0.311
	473.20	0.322
	504.20	0.329
	573.20	0.338
	634.20	0.341
	673.20	0.341
	769.20	0.325
	773.20	0.323
	873.20	0.238
	876.20	0.238
	973.20	0.215
	987.20	0.214
	1073.20	0.205

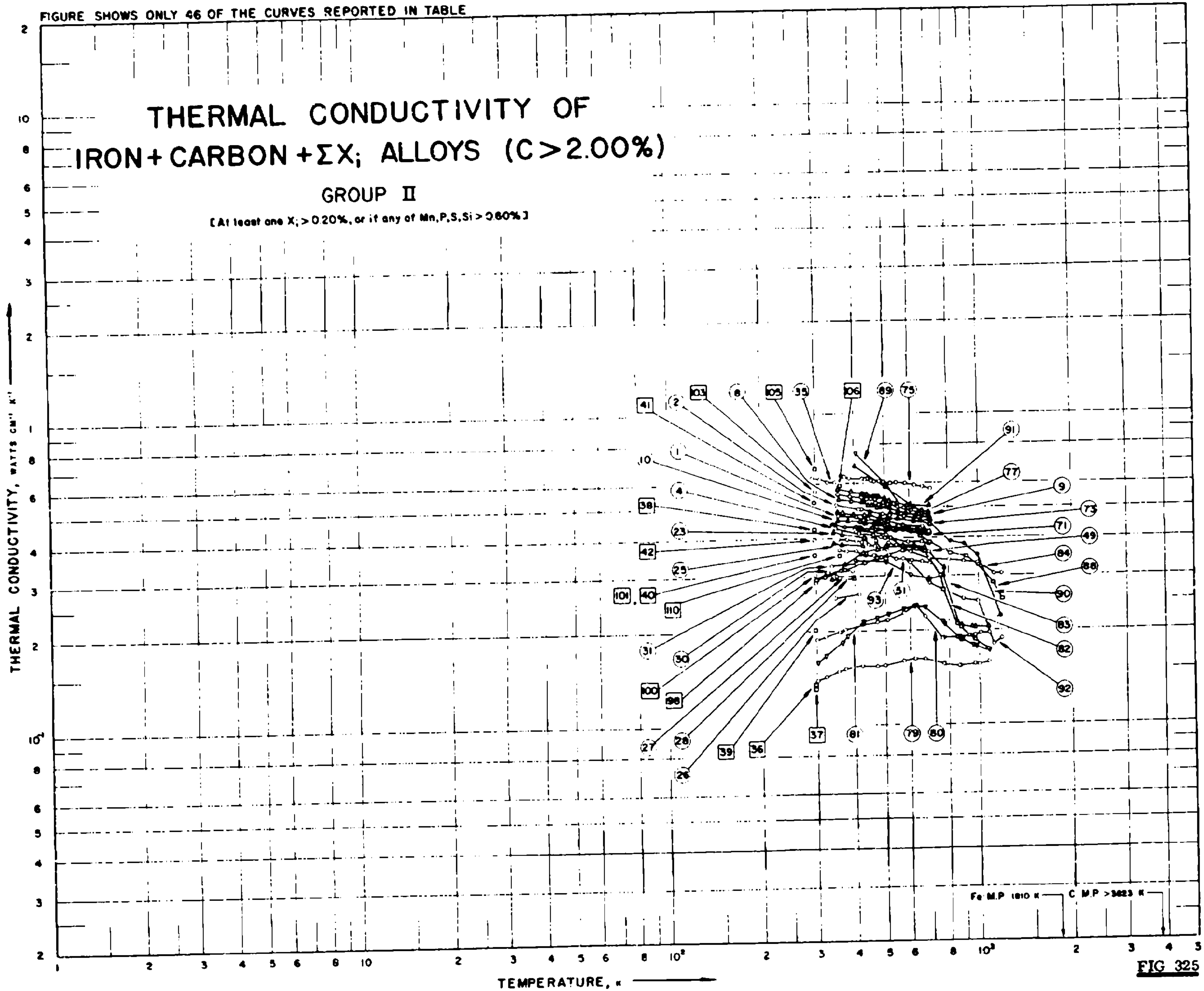


FIGURE SHOWS ONLY 46 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
IRON + CARBON + ΣX; ALLOYS (C > 2.00%)
GROUP II
[At least one X; > 0.20%, or if any of Mn, P, S, Si > 0.60%]
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹
TEMPERATURE, K
Fe M.P. 1810 K
C M.P. > 3823 K

FIG 325

SPECIFICATION TABLE NO. 325 THERMAL CONDUCTIVITY OF [IRON + CARBON + ΣX_i] ALLOYS ($C > 2.00\%$) GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si > 0.60%)

[For Data Reported in Figure and Table 325]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	C	Cr	Cu	Mn	Ni	P	S	Si	Composition (continued), Specifications and Remarks
1	179	L	1939	357-698	2.0	Cu cast iron	3.18		1.58	0.69				1.58	Cast in mold.
2	179	L	1939	352-707	2.0	Cr-Mo cast iron	3.12	0.54		0.38				2.31	0.77 Mo; cast in mold.
3	179	L	1939	356-709	2.0	Mo cast iron	2.56			0.63				2.20	0.58 Mo; cast in mold.
4	179	L	1939	349-696	2.0	Ni-Tensyl cast iron	2.80	0.54		0.66	1.71			2.31	Cast in mold.
5	179	L	1939	355-710	2.0	Ni-Cr cast iron	3.41	0.54		0.65	1.49			1.03	Cast in mold.
6	196	L	1926	361-701	2.0	HD cast iron	3.25			1.87		0.69	0.027	1.56	[2.51 graphitic carbon, 0.74 combined carbon]; as cast.
7	196	L	1928	367-693	2.0	Gray cast iron	3.32			2.43		0.71	0.014	1.52	[2.55 G.C., 0.77 C.C.]; as cast.
8	196	L	1928	359-701	2.0	Cr cast iron:1	3.19	0.198		0.96		0.70	0.049	1.42	[2.49 G.C., 0.70 C.C.]; as cast.
9	196	L	1928	358-697	2.0	Cr cast iron:2	3.17	0.392		0.97		0.69	0.40	1.40	[2.24 G.C., 0.93 C.C.]; as cast.
10	196	L	1928	356-703	2.0	Ni cast iron	3.16			0.94	0.746	0.67	0.095	1.56	[2.50 G.C., 0.67 C.C.]; as cast.
11	196	L	1928	358-707	2.0	V cast iron	3.19			0.99		0.69	0.084	1.45	0.124 V; [2.49 G.C., 0.70 C.C.]; as cast.
12	196	L	1928	355-706	2.0	W cast iron	3.02			0.76		0.68	0.064	1.89	0.475 W; [2.24 G.C., 0.78 C.C.]; as cast.
13	196	L	1928	355-702	2.0	M-4-1	3.34			2.43		0.71	0.014	1.52	[3.08 G.C., 0.26 C.C.]; annealed at 550 C for 200 hrs.
14	196	L	1928	359-702	2.0	Cr-2-1	3.21	0.392		0.97		0.69	0.40	1.40	[2.72 G.C., 0.49 C.C.]; annealed at 550 C for 200 hrs.
15	196	L	1928	362-703	2.0	Ni cast iron; 1	3.15			0.94	0.746	0.67	0.095	1.56	[3.08 G.C., 0.07 C.C.]; annealed at 550 C for 200 hrs.
16	196	L	1928	361-701	2.0	W cast iron; 1	3.05			0.76		0.68	0.064	1.89	0.475 W, [2.45 G.C., 0.60 C.C.]; annealed at 550 C for 200 hrs.
17	197	L	1940	441-668		Cu-33	3.15		1.45	0.58		0.23	0.11	1.58	
18	197	L	1940	367-712		Cu-34	3.18		1.98	0.58		0.23	0.11	1.49	
19	197	L	1940	370-687		Cu-35	3.16		3.10	0.58		0.23	0.11	1.44	
20	198	L	1939	337-437		Cu cast iron:C2a	3.47		1.36	0.468		0.68	0.097	2.03	
21	198	L	1939	335-427		Cu cast iron:C2b	3.47		1.36	0.468		0.68	0.097	2.03	Specimen 35 mm in diameter.
22	198	L	1939	345-448		Cu cast iron:C5a	2.37		1.16	0.447		1.43	0.093	2.05	Specimen 75 mm in diameter.
23	198	L	1939	342-432		Cu cast iron:C5b	2.37		1.16	0.447		1.43	0.093	2.05	Specimen 35 mm in diameter.
24	198	L	1939	347-446		Cu cast iron:C6a	3.31		1.26	0.468		1.56	0.102	2.00	Specimen 75 mm in diameter.
25	198	L	1939	344-429		Cu cast iron:C6b	3.31		1.26	0.468		1.56	0.102	2.00	Specimen 35 mm in diameter.
26	198	L	1939	347, 415		Mn cast iron:P2	2.6/2.9			1.20		1.96	0.06/0.10	2.0	
27	198	L	1939	351, 399		Mn cast iron:F5	2.6/2.9			1.20		1.06	0.06/0.10	2.0	
28	198	L	1939	338, 399		Mn cast iron:P9	2.6/2.9			1.20		0.92	0.06/0.10	2.0	

SPECIFICATION TABLE NO. 325 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	C	Cr	Cu	Mn	Ni	P	S	Si	Composition (continued), Specifications and Remarks
29	198	L	1939	342, 408		Mn cast iron P10	2.6/ 2.9			1.20		0.92	0.06/ 0.10	2.0	
30	198	L	1939	337, 394		Mn cast iron P11	2.6/ 2.9			1.20		1.16	0.06/ 0.10	2.0	
31	198	L	1939	338, 405		Mn cast iron; P12	2.6/ 2.9			1.20		1.16	0.06/ 0.10	2.0	
32	197	L	1940	436- 681		30	3.16			0.57		0.22	0.11	1.54	
33	197	L	1940	433 - 672		31	3.2		0.53	0.57		0.22	0.11	1.50	
34	197	L	1940	433- 672		32	3.18		0.99	0.58		0.23	0.11	1.59	
35	199	L	1899	294- 348			3.40/ 3.60		0.05/ 0.055	0.50/ 0.55		0.053/ 0.058	0.106	1.40	
36	172	E	1927	298		17a	3.82		Trace	0.09		0.009	0.056	1.24	No graphite; cast in iron mold.
37	172	E	1927	298		18a	3.81		Trace	0.05		0.003	0.05	1.96	No graphite; cast in iron mold.
38	172	E	1927	298		19a	3.84		Trace	0.06		0.004	0.021	1.98	3.26 graphite in flaky form; cast in sand mold.
39	172	E	1927	298		17b	3.82		Trace	0.09		0.009	0.056	1.24	Cast, and annealed at 800 C for 1 hr.
40	172	E	1927	298		18b	3.81		Trace	0.05		0.003	0.050	1.96	Cast, and annealed at 800 C for 1 hr.
41	172	E	1927	298		19b	3.84		Trace	0.06		0.004	0.012	1.98	Cast, and annealed at 800 C for 1 hr.
42	172	E	1927	298		17c	3.82		Trace	0.09		0.009	0.056	1.24	Annealed first at 800 C for 1 hr, then at 1000 C for 1 hr.
43	198	L	1939	339- 437		C1a	3.42		0.15	0.447		0.66	0.10	2.10	Specimen 75 mm in diameter.
44	198	L	1939	342- 438		C1b	3.42		0.15	0.447		0.66	0.10	2.10	Specimen 35 mm in diameter.
45	198	L	1939	334- 425		C3a	3.37		0.45	0.436		0.82	0.093	2.07	Specimen 75 mm in diameter.
46	198	L	1939	336- 419		C3b	3.37		0.45	0.436		0.[illegible]	0.0[illegible]	2.07	Specimen 35 mm in diameter.
47	198	L	1939	337- 436		C4a	3.18		0.15	0.468		[illegible]	[illegible]	[illegible]	Specimen 75 mm in diameter.
48	198	L	1939	341- 452		C4b	3.18		0.15	0.468		1.20	[illegible]	2.10	Specimen 35 mm in diameter.
49	200	L	1932	356- 698		Ingot iron; 1	3.77			0.43		0.037	0.[illegible]90	1.[illegible]	[2.95 G. C., 0.82 C. C.]; iron of ingot mold before service.
50	200	L	1932	349- 699		2	3.48/ 3.49			0.73/ 0.74		0.042	0.039	2.05/ 2.08	[2.70 - 2.74 G. C., 0.74 - 0.79 C. C.]; iron of ingot mold before service.
51	200	L	1932	358- 700		3T	3.43/ 3.51			0.78		0.029	0.083	2.44/ 2.46	[2.60 - 2.90 G. C., 0.61 - 0.83 C. C.]; iron from the top of a used ingot mold having a life of 65 casts.
52	200	L	1932	349- 701		3B	3.57/ 3.58			0.74		0.039	0.032	2.20/ 2.23	[2.80 - 2.91 G. C., 0.67 - 0.77 C. C.]; iron from the bottom of a used ingot mold having a life of 65 casts.
53	200	L	1932	348- 698		1A	3.12			0.43				1.86	[2.48 G. C., 0.64 C. C.]; iron from a used ingot mold having a life of 65 casts and being made of the same metal as that of sample 1 above.

SPECIFICATION TABLE NO. 325 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	C	Cr	Cu	Mn	Ni	P	S	Si	Composition (continued), Specifications and Remarks
54	200	L	1932	342- 700		2A	3.36			0.76				2.12	[2.87 G.C., 0.49 C.C.]. Iron from a used ingot mold from the same metal as that of sample 2 above.
55	179	L	1939	358- 700	2.0	1	3.20			0.72				1.56	As cast.
56	179	L	1939	360- 700	2.0	2	3.11			0.39				2.26	As cast.
57	179	L	1939	349- 698	2.0	HD cast iron	2.61			0.45				2.46	As cast.
58	129	C	1933	373- 773	2.0-5.0	C3	3.93			0.63		0.134	0.077	1.40	[3.34 G.C., 0.59 C.C.]; as cast.
59	129	C	1933	373- 773	2.0-5.0	C4	4.16			0.79		0.120	0.040	1.35	[3.50 G.C., 0.66 C.C.]; as cast.
60	196	L	1928	361- 706	2.0	Gray cast iron; S6	3.08			0.94		0.36	0.08	1.24	[2.29 G.C., 0.79 C.C.]; as cast.
61	196	L	1928	358- 703	2.0	S8	3.16			0.97		0.70	0.054	1.48	[2.48 G.C., 0.68 C.C.]; as cast.
62	196	L	1928	350- 691	2.0	S9	3.25			0.97		0.81	0.066	1.91	[2.65 G.C., 0.60 C.C.]; as cast.
63	196	L	1928	365- 700	2.0	S-8-1	3.13			0.97		0.70	0.054	1.48	[3.01 G.C., 0.12 C.C.]; tempered at 550 C for 40 hrs.
64	196	L	1928	356- 665	2.0	S-8-2	3.16			0.97		0.70	0.054	1.48	[3.05 G.C., 0.11 C.C.]; tempered at 550 C for 80 hrs.
65	196	L	1928	350- 655	2.0	S-8-3	3.15			0.97		0.70	0.054	1.48	[3.06 G.C., 0.09 C.C.]; tempered at 550 C for 120 hrs.
66	196	L	1928	357- 665	2.0	S-8-4	3.15			0.97		0.70	0.054	1.48	[3.03 G.C., 0.12 C.C.]; tempered at 550 C for 160 hrs.
67	196	L	1928	356- 697	2.0	S-8-5	3.14			0.97		0.70	0.054	1.48	[3.02 G.C., 0.12 C.C.]; tempered at 550 C for 200 hrs.
68	196	L	1928	351- 705	2.0	S-6-1	3.07			0.94		0.36	0.08	1.24	[2.77 G.C., 0.30 C.C.]; tempered at 550 C for 200 hrs.
69	196	L	1928	356- 696	2.0	S-9-1	3.28			0.97		0.81	0.066	1.91	[3.23 G.C., 0.05 C.C.]; tempered at 550 C for 200 hrs.
70	31	L	1933	346- 690	2.0	1	2.89			0.32		0.27	0.046	1.87	
71	31	L	1933	341- 694	2.0	3	2.87			0.28		0.28	0.045	2.81	
72	31	L	1933	346- 704	2.0	P1	3.34	0.33		0.76		0.18	0.065	1.90	
73	31	L	1933	356- 701	2.0	P2	3.40	0.30		0.92		0.59	0.060	1.90	
74	31	L	1933	352- 709	2.0	P3	3.30	0.31		1.00		0.95	0.050	2.00	
75	31	L	1933	373- 703	2.0	BM	2.36			0.125		0.135	0.080	1.03	[0.13 G.C., 2.23 C.C.].
76	196	L	1928	363- 703	2.0	Gray hot mold; S1	3.35			0.85		0.17	0.12	0.65	[2.44 G.C., 0.91 C.C.]; as cast.
77	196	L	1928	366- 695	2.0	S-1-1	3.34			0.85		0.17	0.12	0.65	[2.62 G.C., 0.72 C.C.]; tempered at 550 C for 200 hrs.
78	201	R	1922	468- 815		Gray soft	3.5			0.64				2.19	Soft cast iron.
79	175	P	1936	303-1073		White cast iron:2	3.16		0.059	0.34		0.329	0.045	0.46	0.34 Mo.
80	175	P	1936	303-1073		White cast iron:3	3.14		0.057	0.37		0.605	0.042	0.47	0.37 Mo.
81	175	P	1936	303-1073		White cast iron:3	2.37		0.071	0.31		0.776	0.036	0.54	0.55 Mo.
82	175	P	1936	303-1073		Grey cast iron:5	3.06		0.087	0.32		0.607	0.049	0.47	0.36 Mo.
83	175	P	1936	303-1073		Grey cast iron:6	3.09		0.184	0.29		0.610	0.048	0.45	0.55 Mo.

SPECIFICATION TABLE NO. 325 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	C	Cr	Cu	Mn	Ni	P	S	Si	Composition (continued), Specifications and Remarks
84	202	R	1956	408-1193	< ±5.0	Cast iron; A	2.98	0.490		1.5	0.130	0.456	0.077	1.94	[0.75 combined carbon]; hypoeutectoid with pearlitic base.
85	202	R	1956	408- 693	< ±5.0	Cast iron; A	2.98	0.490		1.5	0.130	0.456	0.077	1.94	[0.75 combined carbon]; hypoeutectoid with ferritic base.
86	202	R	1956	393-1193	< ±5.0	Cast iron; B	3.95	0.420		0.91	0.090	0.509	0.083	1.82	0.65 W; [0.85 combined carbon]; hypoeutectoid with pearlitic base.
87	202	R	1956	403- 703	< ±5.0	Cast iron; B	3.05	0.420		0.91	0.090	0.509	0.083	1.82	0.65 W; [0.85 combined carbon]; hypoeutectoid with ferritic base.
88	202	R	1956	408-1193	< ±5.0	Cast iron; V	3.82	0.19		0.95	0.15	0.484	0.090	2.02	[0.65 combined carbon]; hypereutectoid with pearlitic base.
89	202	R	1956	408- 688	< ±5.0	Cast iron; V	3.82	0.19		0.95	0.15	0.484	0.090	2.02	[0.65 combined carbon]; hypereutectoid with ferritic base.
90	202	R	1956	403-1173	< ±5.0	Cast iron; G	3.20	0.09		0.88	0.10	0.143	0.116	2.25	[0.61 combined carbon]; eutectic with pearlitic base.
91	202	R	1956	403- 698	< ±5.0	Cast iron; G	3.20	0.09		0.88	0.10	0.143	0.116	2.25	[0.61 combined carbon]; eutectic with ferritic base.
92	202	R	1956	403-1198	< ±5.0	Cast iron; D pl. 25	3.13	0.02		0.94	0.15	0.122	0.01	2.54	0.07 Mg; [0.81 combined carbon]; with pearlitic base.
93	202	R	1956	403- 698	< ±5.0	Cast iron; D pl. 26	2.95	0.02		1.08	0.18	0.126	0.01	2.90	0.08 Mg; [0.75 combined carbon]; with pearlitic base.
94	202	R	1956	403- 693	< ±5.0	Cast iron; D pl. 26	2.95	0.02		1.08	0.18	0.126	0.01	2.90	0.08 Mg; [0.75 combined carbon]; with ferritic base.
95	202	R	1956	408-1198	< ±5.0	Cast iron; E	2.33	0.06		0.36	0.10	0.143	0.069	1.20	[1.20 combined carbon]; with pearlitic base.
96	202	R	1956	408- 693	< ±5.0	Cast iron; E	2.33	0.06		0.36	0.10	0.143	0.069	1.20	[1.20 combined carbon]; with ferritic base.
97	202	R	1956	408- 708	< ±5.0	Cast iron; Zh	3.69	0.05		0.69	0.02	0.28	0.079	1.01	[0.83 combined carbon]; with pearlitic base.
98	203	L	1957	300	±1.5	Cast iron; 2128	≈4.0			0.32				2.4	0.063 Mg; with spherical graphite; annealed at 900 C for 12 hrs and furnace-cooled.
99	203	L	1957	300	±1.5	Cast iron; 2078	≈4.0			0.27	1.0			2.1	0.088 Mg; trace pearlite; with spherical graphite; annealed at 900 C for 12 hrs and furnace-cooled.
100	203	L	1957	300	±1.5	Cast iron; 2131	≈4.0			0.22	1.1			2.1	0.066 Mg; graphite in compact mixed form; annealed at 900 C for 12 hrs and furnace-cooled.
101	203	L	1957	300	±1.5	Cast iron; 2100	≈4.0			0.21	1.1			2.1	0.066 Mg; 40.0 > pearlite; with short laminar graphite; annealed at 900 C for 3 hrs and furnace-cooled.
102	203	L	1957	300	±1.5	Cast iron; 2076	≈4.0			0.23				2.2	With laminar graphite; annealed at 900 C for 12 hrs and furnace-cooled.
103	203	L	1957	300	±1.5	Cast iron; 2077	≈4.0			0.20	1.1			2.2	With laminar graphite; annealed at 900 C for 12 hrs and furnace-cooled.
104	203	L	1957	300	±1.5	Cast iron; 2079	≈4.0			0.26	1.1			2.5	With laminar graphite; annealed at 900 C for 12 hrs and furnace-cooled.

SPECIFICATION TABLE NO. 325 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight per cent) C	Cr	Cu	Mn	Ni	P	S	Si	Composition (continued), Specifications and Remarks
105	203	L	1957	300	± 1.5	Cast iron: 2132	≈4.0			0.22	1.1			2.2	With laminar graphite; annealed at 900 C for 12 hrs and furnace-cooled.
106	204	L	1937	362		Pearlitic pig iron: 41	3.12			2.50				1.26	
107	205	C	1953	358		Nodular iron	3.57			0.33	1.33	0.035	0.004	1.12	0.06 Mg; cast.
108	205	C	1953	358		Nodular iron	3.56			0.33	1.30	0.025	0.010	2.27	0.06 Mg; cast.
109	205	C	1953	358		Nodular iron	3.47			0.29	1.30	0.030	0.012	3.53	0.06 Mg; cast.
110	205	C	1953	358		Nodular iron	3.36			0.40	1.23	0.030	0.010	4.34	0.06 Mg; cast.
111	205	C	1953	358		Nodular iron	3.33			0.50	1.12	0.055	0.010	2.28	0.06 Mg, cast.
112	976	L	1933	373-673		Black temper cast	2.36			0.13		0.135	0.080	1.03	94.5 graphite in C.
113	976	L	1933	373-673		White temper cast	2.80			0.10		0.061	0.093	0.39	72.9 graphite in C.
114	976	L	1933	373-673		Cast iron	2.89			0.32		0.27	0.046	1.87	
115	976	L	1933	373-673		Cast iron	2.87			0.28		0.28	0.045	2.81	
116	976	L	1933	373-673		Cast iron	3.34			0.76		0.18	0.065	1.90	
117	976	L	1933	373-673		Cast iron	3.40			0.92		0.59	0.060	1.90	
118	976	L	1933	373-673		Cast iron	3.30			1.00		0.95	0.050	2.00	

DATA TABLE NO. 325 THERMAL CONDUCTIVITY OF [IRON + CARBON + ΣX_i] ALLOYS ($C > 2.00\%$) GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si > 0.60%)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k
CURVE 1	
356.70	0.473
407.70	0.469
430.70	0.456
444.70	0.460
493.20	0.452
514.70	0.439
518.70	0.452
575.20	0.439
664.20	0.435
697.70	0.418
CURVE 2	
352.20	0.506
415.20	0.494
425.20	0.494
451.70	0.485
496.20	0.477
522.20	0.473
526.20	0.481
581.20	0.469
668.20	0.460
706.70	0.452
CURVE 3*	
355.70	0.494
410.70	0.494
427.70	0.481
458.20	0.481
491.20	0.477
519.70	0.477
524.70	0.469
537.20	0.460
663.20	0.452
708.70	0.448
CURVE 4	
349.20	0.431
414.70	0.414
426.20	0.418
460.20	0.410
487.70	0.402
501.70	0.398
525.20	0.402
CURVE 4 (cont.)	
596.20	0.389
661.20	0.389
695.70	0.381
CURVE 5*	
354.70	0.494
407.70	0.477
427.70	0.481
448.70	0.469
497.70	0.460
516.20	0.464
519.70	0.456
581.70	0.452
667.70	0.444
710.20	0.439
CURVE 6*	
360.70	0.502
394.70	0.494
426.20	0.485
426.70	0.485
451.20	0.485
473.20	0.481
474.20	0.481
493.70	0.473
510.70	0.473
524.20	0.464
526.70	0.464
560.70	0.452
599.20	0.448
640.20	0.439
674.20	0.435
701.20	0.427
CURVE 7*	
356.70	0.494
393.70	0.490
425.20	0.477
430.70	0.481
435.70	0.473
453.20	0.469
468.70	0.469
474.20	0.473
CURVE 7 (cont.)	
490.20	0.460
506.20	0.452
523.20	0.460
551.70	0.448
587.20	0.444
624.70	0.435
660.70	0.427
693.20	0.414
CURVE 8	
358.70	0.536
395.70	0.527
425.20	0.523
428.70	0.523
444.20	0.510
458.70	0.510
476.70	0.502
487.20	0.506
508.20	0.502
521.20	0.498
523.70	0.494
557.20	0.485
588.20	0.477
632.70	0.473
668.20	0.464
701.20	0.460
CURVE 9	
357.70	0.552
389.70	0.544
425.20	0.540
425.70	0.540
440.70	0.536
455.20	0.536
469.20	0.531
470.70	0.519
498.20	0.519
518.20	0.519
523.70	0.515
555.20	0.502
581.70	0.498
614.70	0.490
662.70	0.477
697.20	0.473
CURVE 10	
356.20	0.456
384.70	0.456
420.70	0.452
429.20	0.439
434.70	0.448
468.20	0.448
470.70	0.444
484.70	0.444
505.20	0.439
519.20	0.439
521.70	0.435
549.70	0.431
601.20	0.427
640.70	0.427
681.20	0.423
703.20	0.418
CURVE 11*	
358.20	0.515
389.20	0.502
418.70	0.498
431.70	0.494
450.70	0.494
468.70	0.481
470.70	0.485
487.20	0.481
509.70	0.473
516.20	0.473
524.20	0.469
560.20	0.456
594.20	0.448
635.20	0.444
678.70	0.435
707.20	0.423
CURVE 12*	
354.70	0.498
394.20	0.494
420.70	0.485
435.70	0.481
451.20	0.477
467.20	0.477
473.70	0.477
484.20	0.473
CURVE 12 (cont.)	
506.70	0.469
522.20	0.460
532.70	0.464
566.20	0.452
600.70	0.456
636.70	0.444
677.20	0.439
706.20	0.431
CURVE 13*	
354.70	0.523
390.20	0.510
417.70	0.498
426.70	0.510
445.20	0.490
470.20	0.481
476.70	0.485
486.20	0.481
502.70	0.481
515.70	0.473
521.70	0.477
557.20	0.452
599.70	0.435
635.70	0.435
667.70	0.435
701.70	0.427
CURVE 14*	
359.20	0.569
394.20	0.556
423.20	0.552
428.20	0.552
446.70	0.544
467.70	0.544
475.70	0.536
483.70	0.540
507.20	0.536
519.70	0.527
525.70	0.527
559.20	0.510
596.20	0.498
626.70	0.498
667.70	0.490
702.20	0.477
CURVE 15*	
361.70	0.502
397.20	0.494
422.70	0.490
430.20	0.485
446.70	0.490
467.70	0.481
476.70	0.477
486.70	0.481
504.70	0.473
521.70	0.469
524.70	0.469
558.20	0.469
593.70	0.460
627.20	0.456
666.70	0.448
702.70	0.439
CURVE 16*	
360.70	0.519
397.20	0.515
421.20	0.498
430.70	0.502
440.20	0.502
460.70	0.494
477.20	0.490
486.70	0.490
506.20	0.485
515.20	0.481
522.70	0.485
547.20	0.473
587.20	0.469
634.20	0.460
668.20	0.452
701.20	0.448
CURVE 17*	
440.60	0.431
514.10	0.423
590.10	0.410
667.70	0.406
CURVE 18*	
367.30	0.456
404.60	0.427
435.10	0.448
443.90	0.414
449.90	0.444
482.70	0.431
509.10	0.406
532.90	0.402
588.60	0.389
621.90	0.389
669.10	0.385
712.40	0.389
CURVE 19*	
370.50	0.448
411.50	0.448
438.60	0.444
452.80	0.448
494.20	0.448
519.20	0.423
602.50	0.423
686.50	0.406
CURVE 20*	
336.90	0.510
368.70	0.494
436.70	0.467
CURVE 21*	
335.00	0.490
364.70	0.478
427.20	0.459
CURVE 22*	
344.40	0.437
378.70	0.421
448.20	0.405
CURVE 23	
342.20	0.418
366.70	0.413
431.70	0.397
CURVE 24*	
346.70	0.421
375.70	0.408
445.70	0.396
CURVE 25	
344.20	0.388
365.70	0.383
428.70	0.379
CURVE 26	
347.70	0.255
415.70	0.262
CURVE 27	
351.20	0.300
399.20	0.299
CURVE 28	
338.70	0.294
399.20	0.295
CURVE 29*	
342.20	0.301
408.20	0.295
CURVE 30	
337.70	0.311
394.20	0.311
CURVE 31	
338.70	0.326
405.70	0.330
CURVE 32*	
436.70	0.448
515.80	0.431
597.60	0.418
681.10	0.414

*Not shown on plot

DATA TABLE NO. 325 (continued)

T	k
CURVE 33*	
432.70	0.427
510.80	0.414
590.20	0.410
672.10	0.398
CURVE 34*	
432.90	0.439
510.30	0.427
590.30	0.414
671.90	0.410
CURVE 35	
294.10	0.625
312.10	0.521
329.40	0.608
347.90	0.605
CURVE 36	
298.20	0.136
CURVE 37	
298.20	0.130
CURVE 38	
298.20	0.429
CURVE 39	
298.20	0.203
CURVE 40	
298.20	0.353
CURVE 41	
298.20	0.523
CURVE 42	
298.20	0.397
CURVE 43*	
339.00	0.512
371.20	0.495
436.70	0.467
CURVE 44*	
342.20	0.455
370.20	0.448
437.70	0.432
CURVE 45*	
333.60	0.486
361.20	0.474
424.70	0.460
CURVE 46*	
336.20	0.462
360.20	0.457
419.20	0.441
CURVE 47*	
336.80	0.485
367.70	0.475
436.20	0.446
CURVE 48*	
341.20	0.486
377.20	0.434
451.70	0.418
CURVE 49	
356.20	0.398
380.70	0.398
407.70	0.393
423.20	0.389
434.20	0.398
446.20	0.381
469.20	0.377
470.20	0.393
490.20	0.368
509.70	0.368
CURVE 49 (cont.)	
519.20	0.389
546.20	0.381
582.70	0.377
623.70	0.372
662.20	0.368
698.20	0.360
CURVE 50*	
348.70	0.435
378.70	0.427
411.20	0.423
426.20	0.427
427.20	0.418
455.70	0.414
468.20	0.418
470.20	0.410
482.70	0.410
509.20	0.406
521.70	0.418
548.70	0.406
591.70	0.410
625.70	0.402
655.20	0.402
698.70	0.398
CURVE 51*	
358.20	0.368
375.70	0.364
405.70	0.364
422.20	0.356
438.60	0.356
438.60	0.352
460.70	0.352
466.20	0.352
489.20	0.347
506.70	0.343
518.20	0.352
545.70	0.343
576.20	0.343
615.70	0.339
662.70	0.335
700.20	0.331
CURVE 52*	
349.20	0.410
384.70	0.406
412.20	0.398
424.20	0.393
427.70	0.402
445.20	0.393
464.70	0.389
474.70	0.398
493.70	0.385
511.20	0.381
523.70	0.389
547.70	0.381
582.70	0.381
619.20	0.381
666.70	0.381
701.20	0.368
CURVE 53*	
348.20	0.435
379.20	0.431
412.70	0.423
425.70	0.418
426.70	0.418
447.70	0.414
466.20	0.410
469.20	0.414
483.20	0.410
508.20	0.406
523.70	0.410
550.20	0.402
583.70	0.398
620.20	0.389
655.70	0.385
697.70	0.381
CURVE 54*	
341.70	0.456
361.70	0.452
406.70	0.448
420.20	0.439
422.20	0.444
447.20	0.439
448.70	0.435
461.20	0.435
CURVE 54 (cont.)	
477.70	0.435
509.70	0.427
518.20	0.431
544.70	0.427
584.70	0.414
617.20	0.410
651.20	0.410
700.20	0.402
CURVE 55*	
357.70	0.510
387.20	0.506
425.70	0.494
464.20	0.490
468.70	0.490
498.20	0.481
520.20	0.481
590.20	0.464
666.20	0.448
700.20	0.448
CURVE 56*	
359.70	0.460
411.70	0.456
432.20	0.444
451.20	0.452
490.70	0.452
508.20	0.439
520.70	0.439
581.70	0.435
663.20	0.431
695.70	0.418
CURVE 57*	
348.70	0.460
406.20	0.456
421.20	0.444
454.70	0.448
483.20	0.435
511.20	0.431
514.20	0.439
586.20	0.427
654.20	0.423
698.20	0.414
CURVE 58*	
373.20	0.550
473.20	0.519
573.20	0.488
673.20	0.458
773.20	0.426
CURVE 59*	
373.20	0.528
473.20	0.502
573.20	0.476
673.20	0.449
773.20	0.422
CURVE 60*	
361.20	0.536
390.20	0.527
419.20	0.523
426.20	0.515
449.20	0.515
468.20	0.502
471.20	0.515
496.20	0.506
510.70	0.490
516.20	0.490
538.20	0.490
558.70	0.485
594.20	0.477
633.20	0.469
668.20	0.452
705.70	0.448
CURVE 61*	
357.70	0.515
390.20	0.515
420.20	0.502
425.70	0.502
448.20	0.502
462.20	0.494
471.70	0.498
485.70	0.485
505.20	0.481
523.70	0.477
524.20	0.485
CURVE 61 (cont.)	
562.20	0.469
588.70	0.460
632.70	0.452
671.20	0.448
703.20	0.444
CURVE 62*	
349.20	0.464
379.70	0.464
404.20	0.456
414.20	0.452
424.70	0.456
451.20	0.448
463.20	0.460
475.20	0.444
490.20	0.448
509.20	0.456
510.70	0.452
543.20	0.444
592.20	0.439
637.20	0.435
658.70	0.435
690.70	0.427
CURVE 63*	
365.70	0.569
395.20	0.556
420.70	0.548
431.70	0.552
441.20	0.544
454.70	0.540
477.20	0.531
480.20	0.536
506.20	0.527
517.70	0.527
521.70	0.523
556.20	0.515
586.20	0.502
623.70	0.498
668.70	0.485
700.20	0.473
CURVE 64*	
356.20	0.561
423.20	0.548
502.20	0.523
664.70	0.485
CURVE 65*	
349.70	0.565
413.70	0.548
492.20	0.523
655.20	0.481
CURVE 66*	
357.70	0.548
423.70	0.531
503.20	0.515
665.70	0.473
CURVE 67*	
356.70	0.552
393.70	0.544
421.70	0.536
424.70	0.540
440.20	0.531
458.20	0.527
474.70	0.519
475.70	0.519
499.20	0.510
520.70	0.515
521.20	0.502
555.70	0.498
587.20	0.490
624.70	0.477
660.20	0.469
697.20	0.460
CURVE 68*	
351.20	0.565
385.20	0.552
418.20	0.544
422.70	0.548
438.70	0.536
452.70	0.536

*Not shown on plot

DATA TABLE NO. 325 (continued)

T	k
CURVE 68 (cont.)	
465.20	0.523
474.70	0.527
498.70	0.515
520.70	0.515
521.70	0.510
553.70	0.498
579.20	0.494
621.70	0.485
664.70	0.473
704.70	0.464
CURVE 69*	
356.20	0.510
393.70	0.502
420.70	0.490
421.20	0.490
443.70	0.494
463.70	0.490
472.20	0.481
485.70	0.477
505.70	0.481
519.70	0.473
523.70	0.473
551.20	0.469
586.20	0.460
626.70	0.452
661.70	0.452
696.20	0.444
CURVE 70*	
346.20	0.473
376.70	0.464
411.70	0.464
422.20	0.460
424.20	0.473
437.20	0.460
461.20	0.456
464.20	0.460
484.20	0.456
501.70	0.452
522.20	0.452
543.70	0.448
572.20	0.448
614.20	0.444
CURVE 70 (cont.)	
655.20	0.439
690.20	0.435
CURVE 71	
341.20	0.444
373.20	0.435
406.70	0.435
419.70	0.435
420.70	0.431
440.70	0.427
459.70	0.431
460.20	0.427
480.20	0.427
504.20	0.423
518.70	0.427
542.70	0.423
578.70	0.423
613.70	0.418
654.70	0.414
694.20	0.410
CURVE 72*	
345.70	0.494
375.70	0.490
405.70	0.485
421.70	0.481
433.20	0.485
451.20	0.481
461.70	0.477
470.20	0.477
493.20	0.473
514.20	0.473
516.70	0.469
552.70	0.473
584.70	0.473
622.70	0.460
663.20	0.460
704.20	0.456
CURVE 73	
356.70	0.485
369.20	0.477
399.70	0.473
CURVE 73 (cont.)	
432.70	0.473
432.70	0.473
453.20	0.477
453.70	0.469
472.70	0.469
486.20	0.464
508.20	0.460
513.70	0.460
551.20	0.460
587.70	0.460
625.70	0.452
656.70	0.452
701.20	0.444
CURVE 74*	
352.20	0.469
370.70	0.460
410.20	0.456
428.70	0.460
435.20	0.452
451.20	0.452
456.70	0.452
468.70	0.452
492.70	0.448
519.70	0.444
520.20	0.444
555.20	0.439
585.20	0.439
622.20	0.435
664.20	0.435
708.70	0.431
CURVE 75	
373.70	0.632
386.20	0.628
4[illegible]6.20	0.623
435.70	0.619
441.20	0.623
457.70	0.615
466.70	0.611
482.20	0.611
499.70	0.607
523.20	0.598
529.20	0.611
CURVE 75 (cont.)	
547.70	0.602
585.70	0.598
627.70	0.590
663.20	0.586
703.70	0.577
CURVE 76*	
362.70	0.569
391.70	0.561
419.20	0.565
428.70	0.552
448.20	0.552
462.20	0.544
472.70	0.536
481.70	0.540
505.70	0.527
515.20	0.519
526.20	0.523
563.20	0.506
594.20	0.494
628.20	0.494
668.70	0.477
703.20	0.469
CURVE 77	
366.20	0.577
392.70	0.565
424.70	0.556
434.20	0.552
441.70	0.556
463.20	0.544
473.70	0.544
482.70	0.544
502.70	0.536
519.20	0.523
520.70	0.527
552.70	0.519
493.20	0.506
627.70	0.498
663.70	0.481
695.20	0.477
CURVE 78*	
468.70	0.300
470.80	0.316
558.50	0.404
558.60	0.408
571.80	0.426
676.50	0.604
698.00	0.649
716.10	0.665
777.00	0.802
799.10	0.855
815.10	0.858
CURVE 79	
303.20	0.139
323.20	0.142
355.20	0.149
373.20	0.151
423.20	0.155
473.20	0.154
497.20	0.155
573.20	0.160
626.20	0.163
673.20	0.162
773.20	0.156
778.20	0.156
868.20	0.154
873.20	0.154
973.20	0.156
1004.20	0.156
1073.20	0.158
CURVE 80	
303.20	0.188
323.20	0.191
358.20	0.199
363.20	0.197
373.20	0.201
425.20	0.210
473.20	0.213
509.20	0.216
573.20	0.228
630.20	0.211
673.20	0.221
767.20	0.189
CURVE 80 (cont.)	
773.20	0.190
857.20	0.190
873.20	0.190
973.20	0.193
1010.20	0.196
1073.20	0.196
CURVE 81	
303.20	0.159
323.20	0.167
364.20	0.184
372.20	0.192
428.20	0.212
473.20	0.220
514.20	0.226
573.20	0.235
626.20	0.240
673.20	0.237
765.20	0.213
773.20	0.210
873.20	0.187
882.20	0.187
956.20	0.179
973.30	0.178
1073.30	0.172
CURVE 82	
303.20	0.293
323.20	0.299
363.20	0.312
373.20	0.315
432.20	0.334
473.20	0.345
519.20	0.353
573.20	0.365
634.20	0.370
673.20	0.362
754.20	0.302
773.20	0.270
851.20	0.210
873.20	0.204
936.20	0.192
973.20	0.186
1073.20	0.174
CURVE 83	
303.20	0.291
323.20	0.302
364.20	0.321
373.20	0.329
428.20	0.357
473.20	0.367
567.20	0.374
573.20	0.379
624.20	0.379
673.20	0.372
773.20	0.300
775.20	0.319
861.20	0.208
873.20	0.206
956.20	0.205
973.20	0.205
1073.20	0.205
CURVE 84	
408.20	0.423
508.20	0.410
608.20	0.360
698.20	0.343
808.20	0.339
893.20	0.335
993.20	0.331
1128.20	0.305
1193.20	0.305
CURVE 85*	
408.20	0.485
508.20	0.448
608.20	0.393
693.20	0.360
CURVE 86*	
393.20	0.523
478.20	0.477
578.20	0.431
653.20	0.406
813.20	0.268
943.20	0.259
993.20	0.251
CURVE 86 (cont.)	
1113.20	0.222
1193.20	0.218
CURVE 87*	
403.20	0.536
513.20	0.448
593.20	0.431
703.20	0.368
CURVE 88	
403.20	0.565*
513.20	0.490*
618.20	0.406*
693.20	0.389
818.20	0.356
913.20	0.347
993.20	0.326
1113.20	0.285
1193.20	0.251
CURVE 89	
408.20	0.749
508.20	0.594
608.20	0.469*
688.20	0.435*
CURVE 90	
403.20	0.661*
508.20	0.556*
608.20	0.448*
693.20	0.444*
818.20	0.389
903.20	0.381
993.20	0.351
1173.20	0.222
CURVE 91	
403.20	0.682
508.20	0.586
608.20	0.510
698.20	0.502

* Not shown on plot

DATA TABLE NO. 325 (continued)

T	k
CURVE 92	
403.20	0.385*
508.20	0.351*
608.20	0.335
693.20	0.285
893.20	0.251
993.20	0.247
1128.20	0.184
1198.20	0.188
CURVE 93	
403.20	0.339
508.20	0.335
608.20	0.301
698.20	0.293
CURVE 94*	
403.20	0.347
508.20	0.343
693.20	0.301
CURVE 95*	
408.20	0.469
508.20	0.431
608.20	0.381
698.20	0.347
818.20	0.297
893.20	0.276
993.20	0.218
1123.20	0.180
1198.20	0.176
CURVE 96*	
408.20	0.502
508.20	0.494
608.20	0.431
693.20	0.347
CURVE 97*	
408.20	0.690
518.20	0.598
CURVE 97 (cont.)	
608.20	0.502
708.20	0.473
CURVE 98	
300.00	0.287
CURVE 99*	
300.00	0.292
CURVE 100	
300.00	0.303
CURVE 101	
300.00	0.355
CURVE 102*	
300.00	0.628
CURVE 103	
300.00	0.565
CURVE 104*	
300.00	0.628
CURVE 105	
300.00	0.665
CURVE 106	
361.50	0.597
CURVE 107*	
358.00	0.377
CURVE 108*	
358.00	0.372
CURVE 109*	
358.00	0.362
CURVE 110	
358.00	0.351
CURVE 111*	
358.00	0.357
CURVE 112*	
373.2	0.628
473.2	0.611
573.2	0.598
673.2	0.582
CURVE 113*	
373.2	0.481
473.2	0.464
573.2	0.452
673.2	0.439
CURVE 114*	
373.2	0.469
473.2	0.460
573.2	0.448
673.2	0.439
CURVE 115*	
373.2	0.439
473.2	0.431
573.2	0.423
673.2	0.410
CURVE 116*	
373.2	0.490
473.2	0.477
573.2	0.469
673.2	0.460
CURVE 117*	
373.2	0.481
473.2	0.473
573.2	0.460
673.2	0.448
CURVE 118*	
373.2	0.464
473.2	0.456
573.2	0.444
673.2	0.431

* Not shown on plot

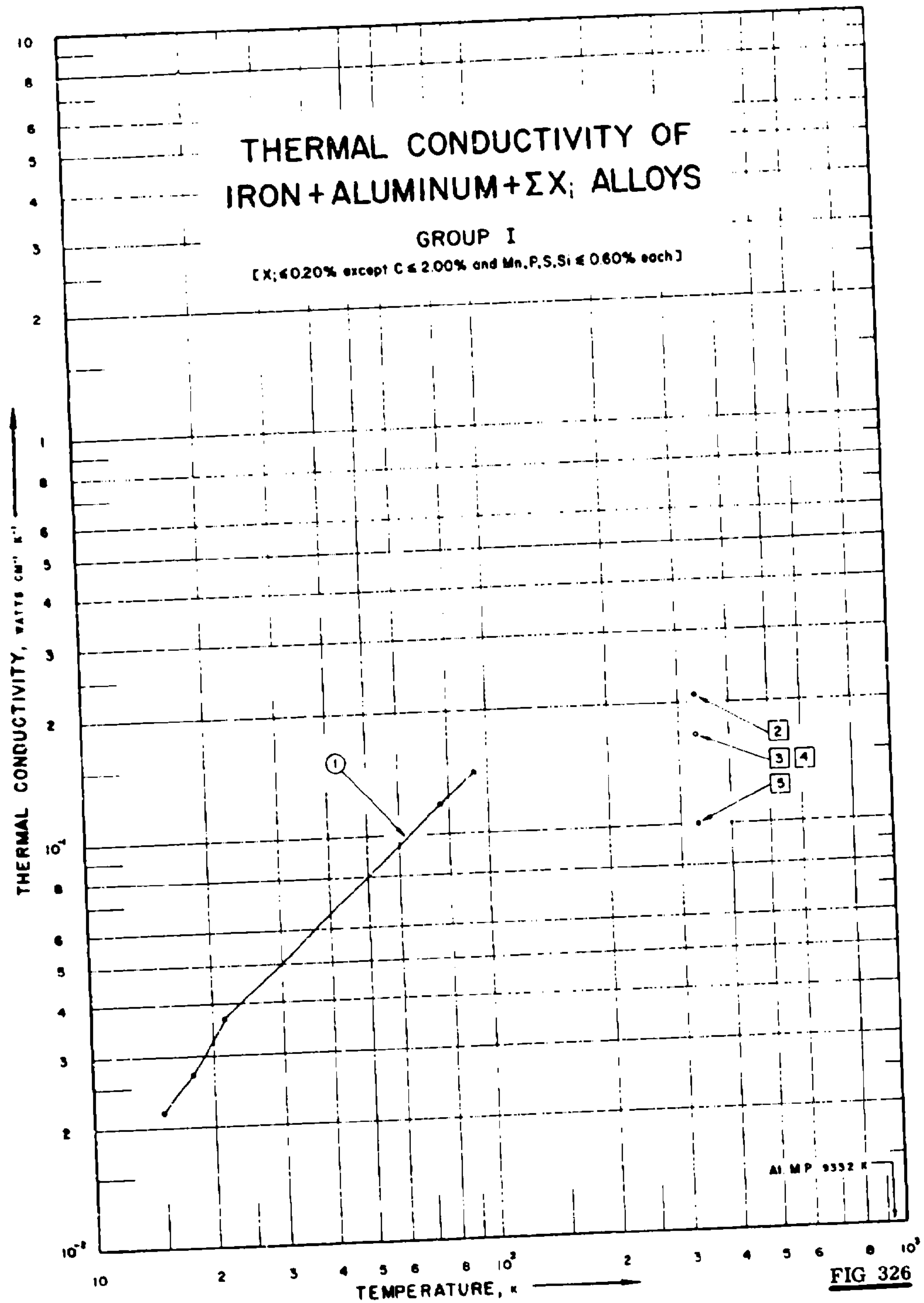

THERMAL CONDUCTIVITY OF
IRON + ALUMINUM + ΣX_i ALLOYS
GROUP I
[X_i ≤ 0.20% except C ≤ 2.00% and Mn, P, S, Si ≤ 0.60% each]
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
4
5
AT. M.P. 9332 K

FIG 326

SPECIFICATION TABLE NO 326 THERMAL CONDUCTIVITY OF [IRON + ALUMINUM + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S, Si $< 0.60\%$ each)

[For Data Reported in Figure and Table No. 326]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	[illegible]	Al	C	Mn	P	S	Si	Composition (continued), Specifications and Remarks
1	104	L	1951	15-93		3792	Bal	4.11	0.03	0.08	0.017	0.006	0.13	Specimen heated to 800 C and furnace cooled; measured in a vacuo of 5×10^{-6} mm Hg.
2	207	F	1934	333			Bal	11.18	<0.1					Sand cast.
3	207	F	1934	333			Bal	12.39	<0.1					Sand cast.
4	207	F	1934	333			Bal	14.36	<0.1					Sand cast.
5	207	F	1934	333			Bal	16.07	<0.1					Sand cast.

DATA TABLE NO. 326 THERMAL CONDUCTIVITY OF [IRON + ALUMINUM + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S, Si $\leq 0.60\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
14.97	0.0218
17.71	0.0269
21.50	0.0368
76.60	0.118
93.10	0.142
CURVE 2	
333.20	0.209
CURVE 3	
333.20	0.167
CURVE 4	
333.20	0.167
CURVE 5	
333.20	0.100

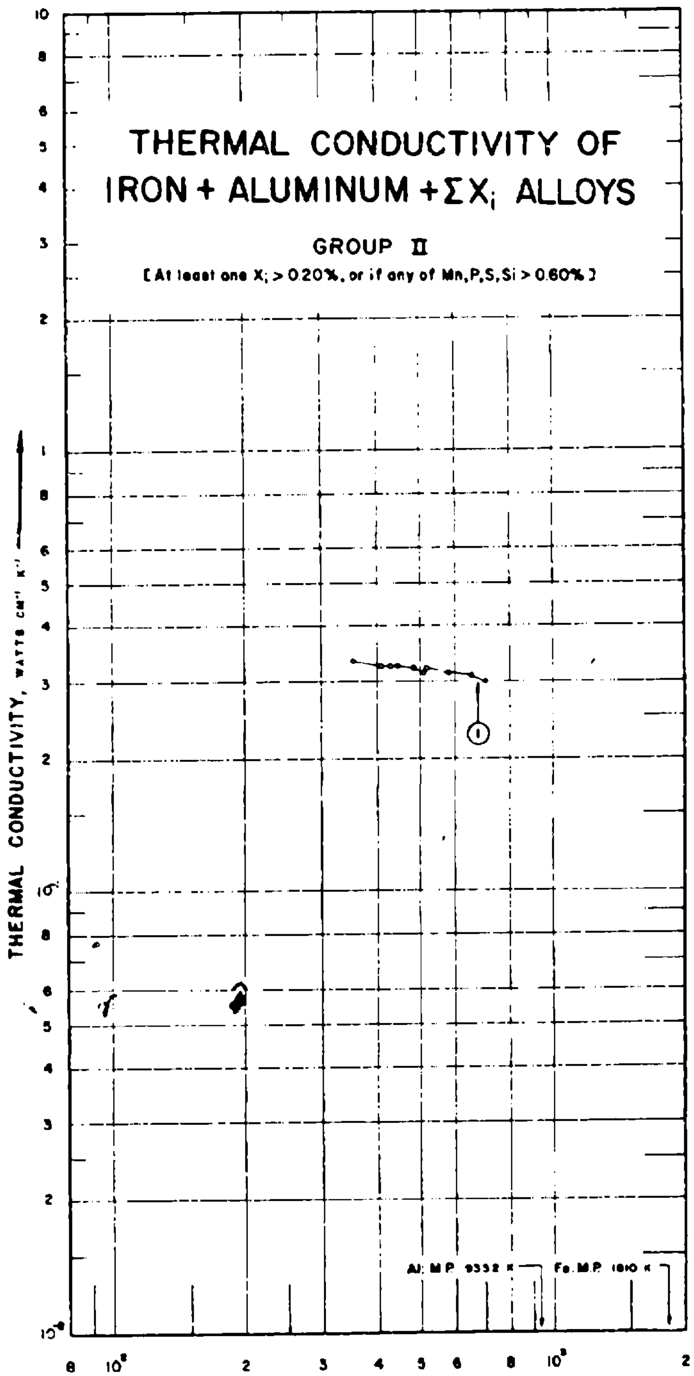

THERMAL CONDUCTIVITY OF
IRON + ALUMINUM + ΣXi ALLOYS
GROUP II
[At least one Xi > 0.20%, or if any of Mn, P, S, Si > 0.60%]
Al M.P. 933.2 K
Fe M.P. 1810 K
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹
TEMPERATURE, K
1

FIG 327

SPECIFICATION TABLE NO. 327 THERMAL CONDUCTIVITY OF [IRON + ALUMINUM + ΣX_i] ALLOYS GROUP II

(At least one X_i > 0.20% or if any of Mn, P, S, Si > 0.60%)

[For Data Reported in Figure and Table No. 327]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Fe	Al	C	Cr	Mn	Si	Composition (continued), Specifications and Remarks
1	179	L	1939	357-703	2.0	Heat resistant cast iron	Bal	7.00	2.70	0.95	0.58	0.96	Specimen 0.75 in. in dia and 15.5 in. long; cast.

DATA TABLE NO. 327 THERMAL CONDUCTIVITY OF [IRON + ALUMINUM + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si $> 0.60\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
356.70	0.335
409.70	0.326
432.20	0.326
447.20	0.326
485.70	0.322
511.70	0.314
523.20	0.322
585.20	0.314
659.20	0.310
703.20	0.301

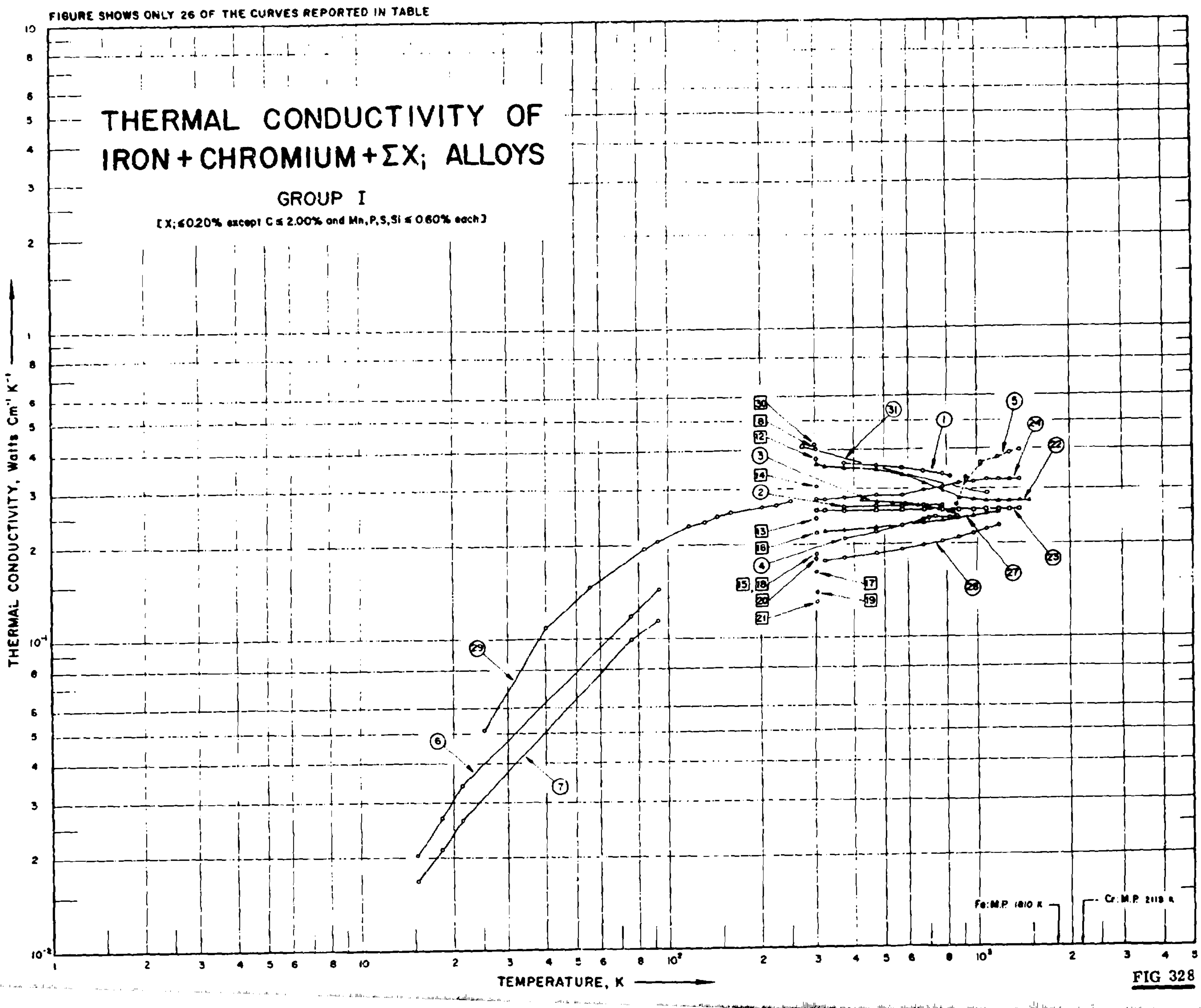


FIGURE SHOWS ONLY 26 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
IRON + CHROMIUM + ΣX; ALLOYS
GROUP I
[X; ≤ 0.20% except C ≤ 2.00% and Mn, P, S, Si ≤ 0.60% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Fe: M.P. 1810 K
Cr: M.P. 2118 K

FIG 328

SPECIFICATION TABLE NO. 328 THERMAL CONDUCTIVITY OF [IRON + CHROMIUM + ΣX_i] ALLOYS GROUP I

($X_i \le 0.20\%$ except C $\le 2.00\%$ and Mn, P, S, Si $\le 0.60\%$ each)

[For Data Reported in Figure and Table No. 328]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Fe	Cr	C	Mn	Ni	P	S	Si	Composition (continued), Specifications and Remarks
1	129	C	1933	373-821	3.0-5.0	S5	Bal	5.15	0.10	0.45		0.013	0.017	0.18	Specimen 2 cm in dia and 15 cm long; hot rolled; annealed; lead used as comparative material; (thermal conductivity value of 0.352 Watt cm^{-1} deg^{-1} at 0 C assumed).
2	129	C	1933	373-773	3.0-5.0	A_1	Bal	15.19	0.08	0.35	0.05	0.02	0.017	0.20	Specimen 2 cm in dia and 15 cm long; cast at 1490 C, cogged, and rolled; annealed at 845 C; lead used as comparative material (k = 0.352 Watt cm^{-1} deg^{-1} at 0 C).
3	129	C	1933	373-865	3.0-5.0	A_4	Bal	26.0	0.10	0.40	0.18	0.013	0.008	0.45	Similar to the above specimen except cast at 1500 C.
4	37	C	1951	426-843	4.0	AISI 403 stainless	Bal	12.0	0.15						Lead or a sample calibrated against lead used as comparative material.
5	43	L	1958	852-1380	5.0	AISI 446 stainless	70.55	27.61	0.086						0.01 Mo; specimen 6.75 in. in dia and 1.5 in. thick.
6	104	L	1951	15-93		3632 A	Bal	13.57	0.36	0.13				0.22	Specimen heated to 800 C and furnace cooled; measured in a vacuo of 5 x 10^{-6} mm Hg.
7	104	L	1951	15-92		3632 B	Bal	13.57	0.36	0.13				0.22	Specimen heated to 950 C and oil quenched; measured in a vacuo of 5 x 10^{-6} mm Hg.
8	176	E	1920	303		3a	Bal	1.0	0.6						Annealed at 900 C and cooled slowly.
9	176	E	1920	303		3b	Bal	1.0	0.6						Annealed at 1100 C and cooled quickly.
10	176	E	1920	303		4a	Bal	2.0	0.6						Annealed at 900 C and cooled slowly.
11	176	E	1920	303		4b	Bal	2.0	0.6						Annealed at 1100 C and cooled quickly.
12	176	E	1920	303		5a	Bal	3.0	0.6						Annealed at 900 C and cooled slowly.
13	176	E	1920	303		5b	Bal	3.0	0.6						Annealed at 1100 C and cooled quickly.
14	176	E	1920	303		6a	Bal	5.0	0.6						Annealed at 900 C and cooled slowly.
15	176	E	1920	303		6b	Bal	5.0	0.6						Annealed at 1100 C and cooled quickly.
16	176	E	1920	303		7a	Bal	10.0	0.6						Annealed at 900 C and cooled slowly.

SPECIFICATION TABLE NO. 328 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Fe	Cr	C	Mn	Ni	P	S	Si	Composition (continued), Specifications and Remarks
17	176	E	1920	303.2		7b	Bal	8.5	0.6						Annealed at 1100 C and cooled quickly.
18	176	E	1920	303.2		8a	Bal	15.0	0.6						Annealed at 900 C and cooled slowly.
19	176	E	1920	303.2		8b	Bal	13.0	0.6						Annealed at 1100 C and cooled quickly.
20	176	E	1920	303.2		9a	Bal	20.0	0.6						Annealed at 900 C and cooled slowly.
21	176	E	1920	303.2		9b	Bal	17.0	0.6						Annealed at 1100 C and cooled quickly.
22	163	L	1936	303-1473		1	Bal	4.98	0.01	0.04				0.02	Forged.
23	163	L	1936	303-1373		6	Bal	13.08	0.07	0.04				0.02	Forged.
24	163	L	1936	303-1373		7	Bal	13.10	1.52	0.38				0.38	Forged.
25	163	L	1936	303-1273		9	Bal	20.63	0.07	0.06				0.03	Usual heat treatment.
26	166	C	1939	273-623		16	Bal	12.95	0.13	0.25	0.14	0.018	0.024	0.17	0.034 Al, 0.060 Cu, 0.012 V, 0.015 As; specimen 8 in. long; heated at 960 C in air, tempered at 750 C for 2 hrs and air cooled; iron used as comparative material; measured in a vacuum of ~0.2 mm Hg.
27	131	C	1953	323-1173	2	AISI 430 stainless	82.4	17.2	0.102	0.254			0.035		Annealed at 1050 C; lead used as comparative material.
28	131	C	1953	323-1173	2	AISI 446 stainless	76.44	23.53	0.152	0.043			0.021		Annealed at 900 C; lead used as comparative material.
29	115	L	1951	25-250	~2	AISI 410 stainless	Bal	12.60	9.99	0.32	0.12	0.012	0.011	0.36	0.06 Cu, 0.03 N.
30	177	C	1936	298	10		Bal	3.53	0.14	0.23		0.018		0.26	Normalized.
31	563	L	1935	273, 1073		Russian steel	Bal	1.15	0.32	0.63	0.10	0.028	0.023	0.31	0.17 Mo.
32	490	F	1950	273-1173			Bal	26.00	0.13	0.56	0.10	0.012	0.007	0.50	0.14 N.
33	564	C	1958	463-953		AISI 430 stainless	Bal	14.00/ 18.00	0.12 Max						Nominal composition from Metal's Handbook; alumina (Body Al-300) used as comparative material.
34	564	C	1958	463-953		AISI 430 stainless	Bal	14.00/ 18.00	0.12 Max						Nominal composition from Metal's Handbook; the above specimen measured using different alumina (Body Al-300) as comparative material.

DATA TABLE NO. 328 THERMAL CONDUCTIVITY OF [IRON + CHROMIUM + ΣX_i] ALLOYS GROUP I

(X_i < 0.20% except C < 2.00% and Mn, P, S, Si < 0.60% each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

CURVE 1

T	k
373.20	0.366
473.20	0.358
573.20	0.351
673.20	0.343
773.20	0.336
821.20	0.330

CURVE 2

T	k
373.20	0.261
473.20	0.262
573.20	0.262
673.20	0.262
773.20	0.263

CURVE 3

T	k
373.20	0.209
473.20	0.219
573.20	0.229
673.20	0.238
700.10	0.240
735.40	0.242
818.10	0.241
864.90	0.244

CURVE 4

T	k
426.00	0.273
477.60	0.270
533.20	0.268
588.70	0.267
644.30	0.262
699.80	0.259
755.40	0.256
810.90	0.252
842.60	0.249

CURVE 5

T	k
852.40	0.267
856.50	0.265
918.90	0.318
918.90	0.327
920.20	0.320
1029.30	0.363

CURVE 5 (cont.)

T	k
1030.10	0.360
1170.10	0.377
1171.70	0.377
1270.80	0.391
1270.80	0.389
1380.40	0.395

CURVE 6

T	k
15.26	0.0204
16.37	0.0268
21.53	0.0339
75.40	0.118
93.00	0.144

CURVE 7

T	k
15.30	0.0168
18.29	0.0212
21.38	0.0264
75.80	0.099
92.40	0.114

CURVE 8

T	k
303.20	0.402

CURVE 9*

T	k
303.20	0.369

CURVE 10*

T	k
303.20	0.400

CURVE 11*

T	k
303.20	0.364

CURVE 12

T	k
303.20	0.375

CURVE 13

T	k
303.20	0.241

CURVE 14

T	k
303.20	0.305

CURVE 15

T	k
303.20	0.186

CURVE 16

T	k
303.20	0.218

CURVE 17

T	k
303.20	0.162

CURVE 18

T	k
303.20	0.186

CURVE 19

T	k
303.20	0.140

CURVE 20

T	k
303.20	0.179

CURVE 21

T	k
303.20	0.130

CURVE 22

T	k
303.20	0.360
323.20	0.356
373.20	0.352
473.20	0.347
573.20	0.335
673.20	0.314
773.20	0.297
873.20	0.280
973.20	0.276
1073.20	0.272
1173.20	0.272
1273.20	0.272
1373.20	0.272
1473.20	0.272

CURVE 23

T	k
303.20	0.255
323.20	0.255
373.20	0.255
473.20	0.255
573.20	0.255
673.20	0.255
773.20	0.255
873.20	0.255
973.20	0.255
1073.20	0.255
1173.20	0.255
1273.20	0.255
1373.20	0.255

CURVE 24

T	k
303.20	0.276
323.20	0.276
373.20	0.280
473.20	0.285
573.20	0.285
673.20	0.297
773.20	0.305
873.20	0.314
973.20	0.318
1073.20	0.322
1173.20	0.322
1273.20	0.322
1373.20	0.322

CURVE 25*

T	k
303.20	0.234
323.20	0.234
373.20	0.234
473.20	0.234
573.20	0.234
673.20	0.239
773.20	0.243
873.20	0.247
973.20	0.251
1073.20	0.264
1173.20	0.276
1273.20	0.293

CURVE 26*

T	k
273.20	0.270
323.20	0.272
373.20	0.276
423.20	0.276
473.20	0.278
523.20	0.278
573.20	0.280
623.20	0.280

CURVE 27

T	k
323.20	0.220
373.20	0.222
473.20	0.226
573.20	0.229
673.20	0.233
773.20	0.237
873.20	0.240
973.20	0.244
1073.20	0.248
1173.20	0.252

CURVE 28

T	k
323.20	0.176
373.20	0.180
473.20	0.186
573.20	0.192
673.20	0.198
773.20	0.204
873.20	0.210
973.20	0.216
1073.20	0.222
1173.20	0.228

CURVE 29

T	k
25.14	0.0510
40.26	0.109
55.64	0.147
83.62	0.193
92.60	0.205
117.48	0.230
132.17	0.238
145.16	0.245
160.09	0.252

CURVE 29 (cont.)

T	k
202.21	0.261
225.28	0.265
250.12	0.272

CURVE 30

T	k
298.20	0.414

CURVE 31

T	k
273.2	0.406
1073.2	0.290

CURVE 32*

T	k
273.2	0.226
373.2	0.238
473.2	0.255
573.2	0.272
673.2	0.285
773.2	0.301
873.2	0.318
973.2	0.335
1073.2	0.351
1173.2	0.364

CURVE 33*

T	k
463.2	0.197
524.2	0.199
633.2	0.208
658.2	0.220
759.2	0.224
850.2	0.236
953.2	0.277

CURVE 34*

T	k
463.2	0.201
524.2	0.203
633.2	0.209
658.2	0.214
759.2	0.234
850.2	0.247
953.2	0.261

*Not shown on plot

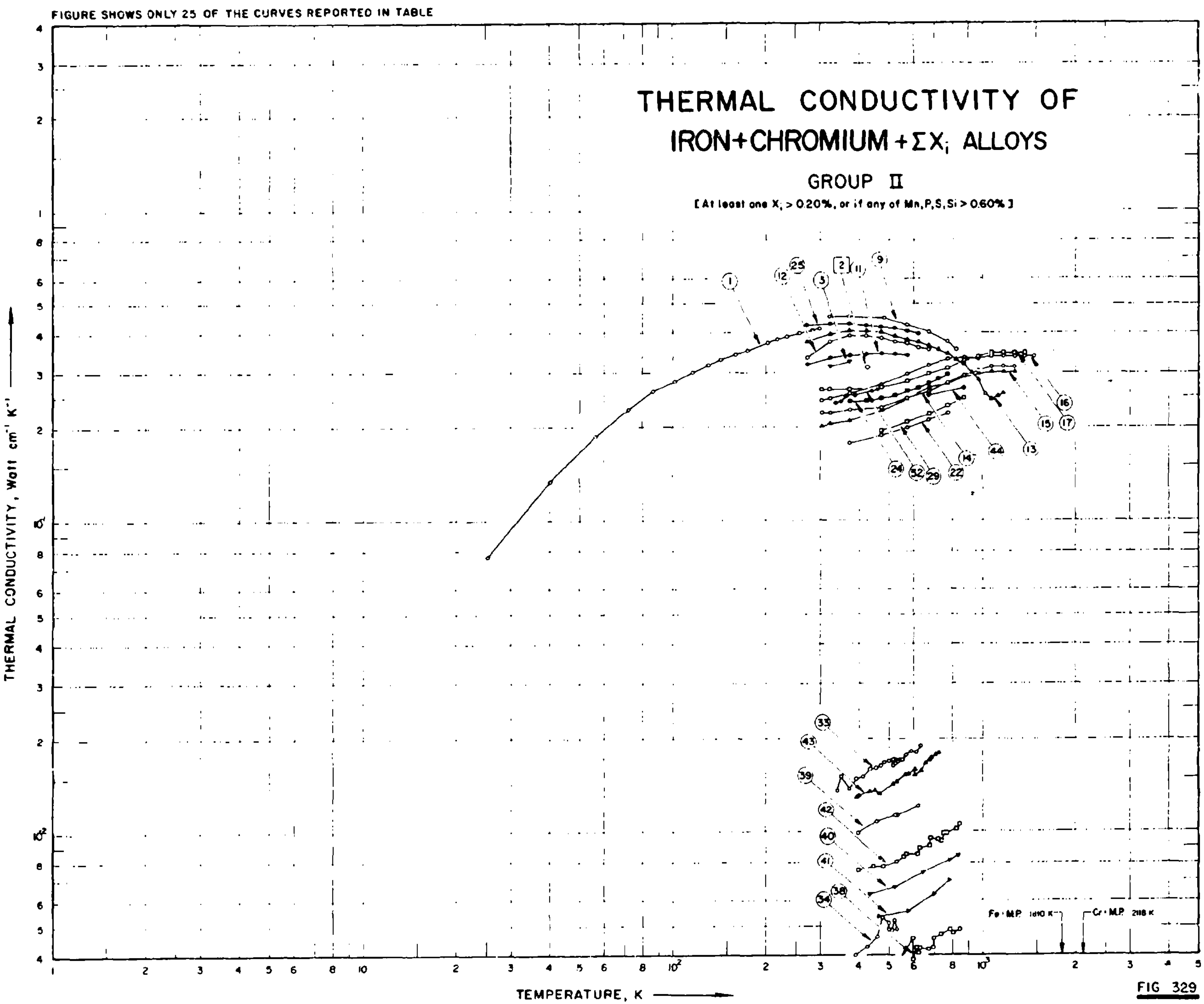


FIGURE SHOWS ONLY 25 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
IRON+CHROMIUM+ΣX_i ALLOYS
GROUP II
[At least one X_i > 0.20%, or if any of Mn,P,S,Si > 0.60%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Fe·M.P. 1810 K
Cr·M.P. 2118 K

FIG 329

SPECIFICATION TABLE NO. 329 THERMAL CONDUCTIVITY OF [IRON + CHROMIUM + ΣX_i] ALLOYS ($C < 2.00\%$) GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si > 0.60%)

[For Data Reported in Figure and Table No. 329]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Fe	Cr	C	Mn	Mo	Ni	Si	S	Composition (continued), Specifications and Remarks
							Composition (weight percent)								
1	115	L	1951	25-298	~2	SAE4130	bal.	0.99	0.33	0.52	0.22	0.17	0.20		Specimen supplied by Carnegie Illinois Steel Corp.
2	180	C	1950	428	2		bal.	6.65	0.16	0.69	0.52		0.44	0.020	0.20 Cu, 0.014 P; annealed at 900 C for 1 hr, cooled in still air, annealed at 750 C for 1 hr, and cooled in still air. Ni used as comparative material.
3	173	C	1956	323,373		En19a	bal.	1.15	0.42	0.59	0.22	0.33	0.23	0.019	0.046 P; oil-quenched from 850 C, supplied by Messrs. Brown Bayley Steels Ltd.; specimen (tube) 1 in. O.D. 0.75 in. I.D.
4	173	C	1956	323,373		En19b	bal.	1.15	0.42	0.59	0.22	0.33	0.23	0.019	0.046 P; the above specimen tempered for 3 hr at 150 C.
5	173	C	1956	323-473		En19c	bal.	1.15	0.42	0.59	0.22	0.33	0.23	0.019	0.046 P; the above specimen tempered for 3 hr at 350 C.
6	173	C	1956	323-473		En19d	bal.	1.15	0.42	0.59	0.22	0.33	0.23	0.019	0.046 P; the above specimen tempered for 3 hr at 550 C.
7	173	C	1956	323-473		En19e	bal.	1.15	0.42	0.59	0.22	0.33	0.23	0.019	0.046 P; the above specimen tempered for 3 hr at 650 C.
8	173	C	1956	323-473		En19f	bal.	1.15	0.42	0.59	0.22	0.33	0.23	0.019	0.046 P; the above specimen annealed for 1 hr at 850 C.
9	173	C	1956	323-823		En19g	bal.	1.15	0.42	0.59	0.22	0.33	0.23	0.019	0.046 P; the above specimen reheated to 650 C for 120 hr.
10	173	C	1956	273-373		En31a	bal	1.5	1.05	0.73	0.21	0.23	0.23	0.028	0.030 P; specimen 1 in. dia; oil-quenched from 830 C; tempered at 140 C for 6 hr.
11	173	C	1956	273-573		En31b	bal.	1.5	1.05	0.73	0.21	0.23	0.23	0.028	0.030 P; the above specimen tempered at 150 C for 2 hr.
12	173	C	1956	273-673		En31c	bal.	1.5	1.05	0.73	0.21	0.23	0.23	0.028	0.030 P; the above specimen tempered at 350 C for 3 hr.
13	173	C	1956	273-1173		En31d	bal.	1.5	1.05	0.73	0.21	0.23	0.23	0.028	0.030 P; the above specimen tempered at 550 C for 4 hr.
14	163	L	1936	303-1273		2	bal.	8.92	0.44	0.85			3.36		0.27 V; usual heat treatment.
15	163	L	1936	393-1273		3	bal.	2.04	0.41	0.33			4.33		Usual heat treatment.
16	163	L	1936	303-1473		4	bal.	2.05	8.39	0.48			3.36		Usual heat treatment.

SPECIFICATION TABLE NO. 329 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Fe	Cr	C	Mn	Mo	Ni	Si	S	Composition (continued), Specifications and Remarks
17	163	L	1936	303-1373		5	bal.	2.91	0.45	0.36			3.62		1.18 Co; usual heat treatment.
18	163	L	1936	303-1373		8	bal.	13.35	1.36	0.47	1.13		0.16		1.89 Co; usual heat treatment.
19	181	+C	1953	373-973		H-20	bal.	2.7	0.23		0.5	0.3			0.75 V, 0.5 W; measured in vacuo.
20	181	+C	1953	373-973		H-27	bal.	3.0	0.4	0.6	0.8		0.3		0.2 V; measured in vacuo.
21	181	+C	1953	373-1073		H-46	bal.	11.0	0.2	0.4	0.5		0.3		0.7 V, 0.15 Nb; measured in vacuo.
22	129	C	1933	373-773	~4	A_5	bal.	17.12	1.10	0.30		0.35	0.47		1.55 Al; annealed at 900 C; specimen 2 cm in. dia and 15 cm long; lead used as comparative material.
23	169	R	1936	273-773		4		0.86	0.60	0.54			0.29		0.21 V.
24	182	L	1959	273-773	5	AISI440-C	bal.	16 18	0.95 1.20		0.75 max				Nominal composition; specimen 75 in. dia, 7.5 in. long, measured in a vacuo of $<10^{-5}$ mm of Hg
25	166	C	1939	273-623		20	bal.	0.88	0.35	0.59	0.20	0.26	0.21	0.031	0.12 Cu, 0.039 As, 0.028 P, 0.004 Al; annealed at 860 C, reheated to 640 C and furnace cooled; density 7.845 g cm^{-3}; iron used as comparative material.
26	129, 151	C	1933	373-573	~4	A_2	bal.	12.0	0.07	0.09		0.23	0.99	0.01	0.015 P; specimen 2 cm dia, 15 cm long; annealed at 845 C; lead used as comparative material.
27	166	C	1939	273-573		19	bal.	1.09	0.515	0.69	0.012	0.073	0.20	0.036	0.066 Cu, 0.039 P, 0.028 As, 0.005 Al; annealed at 860 C; density 7.842 g cm^{-3}; iron used as comparative material.
28	166	C	1939	273-573		17	bal.	13.69	0.27	0.28	0.01	0.20	0.18	0.022	0.25 W, 0.074 Cu, 0.03 Al, 0.022 P, 0.022 V, 0.003 As; heated at 960 C in air, tempered 2 hr at 750 C and air cooled; density 7.741 g cm^{-3}; iron used as comparative material.
29	613	C	1958	473-873		AISI430 stainless	bal.	14/ 18	0.12 max	1			1		Nominal composition; alumina used as comparative material (Wesgo Al-30).
30	183	C	1956	303,353		20Q	bal.	0.88	0.35	0.59	0.20	0.26	0.21	0.031	0.12 Cu, 0.039 As, 0.028 P, 0.004 Al, trace V; quenched from 1000 C; annealed at 100 C for several hrs; iron used as comparative material.
31	183	C	1956	323-1073		En31	bal.	1.46	1.06	0.045		0.31	0.24	0.013	0.017 P; annealed; iron used as comparative material.

SPECIFICATION TABLE NO. 329 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Fe	Cr	C	Mn	Mo	Ni	Si	S	Composition (continued), Specifications and Remarks
32	616		194?	473-773		SAE 4140	bal.	0.80/ 1.10	0.38/ 0.43	1.50/ 0.25			0.20/ 0.35	0.04 max	0.040 (max) P; nominal composition from Metals Handbook.
33	995	R	1953	340-631		AISI446 stainless	bal.	23/ 27	0.35 max	1.50 max			1.00 max	0.03 max	0.25 (max) N, 0.040 (max) P; powder (0.000583 ft dia); measured with 0.53 volume fraction He, nominal composition from Metals Handbook.
34	995	R	1953	350-532		AISI446 stainless	bal.	23/ 27	0.35 max	1.50 max			1.00 max	0.03 max	0.25 (max) N, 0.040 (max) P; (0.000583 ft dia); measured with 0.53 volume fraction air; nominal composition from Metals Handbook.
35	995	R	1953	366-579		AISI446 stainless	bal.	23/ 27	0.35 max	1.50 max			1.00 max	0.03 max	0.25 (max) N, 0.040 (max) P; powder (0.000583 ft dia); measured with 0.53 volume fraction argon; nominal composition from Metal Handbook.
36	327	C	1943	673.2			bal.	1.35	0.31		0.50				0.20 V; annealed 2 hrs at 700 C, then oil-quenched.
37	327	C	1943	673.2			bal.	1.59	0.32		0.35				0.26 V; annealed 2 hrs at 700 C, then oil-quenched.
38	581	R	1958	577-845		AISI446 stainless	bal.	23/ 27	0.35 max	1.50 max			1.00 max	0.03 max	0.25 (max) N; 0.040 (max) P; nominal composition; powder (mean dia 0.000583 ft) with 0.5 volume fraction argon.
39	581	R	1958	397-622		AISI446 stainless	bal.	23/ 27	0.35 max	1.50 max			1.00 max	0.03 max	0.25 (max) N; 0.040 (max) P; nominal composition; powder (mean dia 0.000583 ft) with 0.5 volume fraction containing mixture of helium and argon (He; A = 2.333).
40	581	R	1958	432-838		AISI446 stainless	bal.	23/ 27	0.35 max	1.50 max			1.00 max	0.03 max	0.25 (max) N; 0.040 (max) P; nominal composition; powder (mean dia 0.000583 ft) with 0.5 volume fraction containing a mixture of neon and argon (Ne; A = 1.941).

SPECIFICATION TABLE NO. 329 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Fe	Cr	C	Mn	Mo	Ni	Si	S	Composition (continued), Specifications and Remarks
							Composition (weight percent)								
41	581	R	1958	464-786		AISI446 stainless	bal.	23/27	0.35 max	1.50 max			1.00 max	0.03 max	0.25 (max) N; 0.040 (max) P; nominal composition; powder (mean dia 0.000583 ft) with 0.5 volume fraction containing a mixture of neon and argon (Ne:A ~ 1.000).
42	581	R	1958	397-849		AISI446 stainless	bal.	23/27	0.35 max	1.50 max			1.00 max	0.03 max	0.25 (max) N, 0.040 (max) P; nominal composition; powder (mean dia 0.000583 ft) with 0.5 volume fraction neon.
43	581	R	1958	392-723		AISI446 stainless	bal.	23/27	0.35 max	1.50 max			1.00 max	0.03 max	0.25 (max) N; 0.040 (max) P; nominal composition; powder (mean dia 0.000583 ft) with 0.5 volume fraction helium.
44	977, 978	E	1962	473-873		EI 802 steel		14.81	0.16	0.63	0.59	0.42	0.21	0.014	0.01 P, 1.03 W, and 0.24 V; heated to 1000 C, oil quenched; electrical resistivity 0.127, 0.105, and 0.0976 milliohm cm at 200, 400, and 600 C, respectively.
45	977, 978	E	1962	473-873		EI 802 steel									Same composition as the above specimen; heated to 1000 C, oil quenched, tempered at 680 C for 10 hrs; electrical resistivity 0.139, 0.113, and 0.0956 milliohm cm at 200, 400, and 600 C, respectively.
46	977, 978	E	1962	473-873		EI 802 steel									Same composition as the above specimen; heated to 1000 C, oil quenched, tempered at 680 C for 10 hrs, and at 650 C, for 1000 hrs; electrical resistivity 0.141, 0.111, and 0.0867 milliohm cm at 200, 400, and 600 C, respectively.
47	977, 978	E	1962	473-873		EI 802 steel									Same composition as the above specimen; heated to 1000 C, oil quenched, tempered at 680 C for 10 hrs, and at 600 C, for 1000 hrs; electrical resistivity 0.148, 0.115, and 0.101 at 200, 400, and 600 C, respectively.

SPECIFICATION TABLE NO. 329 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Fe	Cr	C	Mn	Mo	Ni	Si	S	Composition (continued), Specifications and Remarks
48	977, 978	E	1962	473-873		EI 802 steel									Same composition as the above specimen; heated to 1000 C, oil quenched, tempered at 700 C for 10 hrs; electrical resistivity 0.140, 0.114, and 0.0951 milliohm cm at 200, 400, and 600 C, respectivity.
49	977, 978	E	1962	473-873		EI 802 steel		11.81	0.6	0.63	0.59	0.42	0.21	0.014	0.01 P, 1.03 W, and 0.24 V; heated to 1100 C, oil quenched; electrical resistivity 0.137, 0.114, and 0.0981 milliohm cm at 200, 400, and 600 C, respectively.
50	977, 978	E	1962	473-873		EI 802 steel									Same composition as the above specimen; heated to 1150 C, oil quenched, tempered at 700 C for 10 hrs; electrical resistivity 0.140, 0.116, and 0.0965 milliohm cm at 200, 400, and 600 C, respectively.
51	973	L	1966	312-436	< 6	T 12		12.4	0.13	1.04	0.10	0.25	0.56	0.036	0.031 P; specimen 1.27 cm in dia and 15 cm long; annealed at 950 C, oil quenched from 950 C and tempered at 760 C; cast condition; electrical resistivity 61.2, 63.4, 65.4, 67.3, 69.7, and 72.7 μohm cm at 20, 45, 62, 91, 123, and 159 C respectively.
52	973	L	1966	324-459	< 6	T 12									Similar to the above specimen except in wrought condition and electrical resistivity 61.8, 65.6, 67.3, 69.3, 73.6, and 75.1 μohm cm, at 22, 66, 92, 114, 170, and 187 C respectively.

DATA TABLE NO. 329 THERMAL CONDUCTIVITY OF [IRON + CHROMIUM + ΣX_i] ALLOYS ($C < 2.00\%$) GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si $> 0.60\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

CURVE 1

T	k
25.34	0.077
40.24	0.134
56.06	0.187
72.02	0.228
86.76	0.259
101.74	0.280
116.56	0.301
131.22	0.318
143.92	0.331
159.90	0.344
175.18	0.353
203.22	0.372
218.40	0.381
235.03	0.390
256.88	0.399
284.04	0.408
298.38	0.412

CURVE 2

T	k
427.70	0.312

CURVE 3

T	k
323.20	0.315
373.20	0.325

CURVE 4*

T	k
323.20	0.330
373.20	0.335

CURVE 5

T	k
323.20	0.360
373.20	0.370
473.20	0.37

CURVE 6*

T	k
323.20	0.385
373.20	0.409
473.20	0.400

CURVE 7*

T	k
323.20	0.440
373.20	0.455
473.20	0.460

CURVE 8*

T	k
323.20	0.425
373.20	0.435
473.20	0.425

CURVE 9

T	k
323.20	0.450
373.20	0.450
473.20	0.445
573.20	0.425
673.20	0.400
773.20	0.375
823.20	0.355

CURVE 10*

T	k
273.20	0.225
323.20	0.243
373.20	0.257

CURVE 11

T	k
273.20	0.320
323.20	0.335
373.20	0.34
423.20	0.345
473.20	0.345
523.20	0.345
573.20	0.340

CURVE 12

T	k
273.20	0.335
323.20	0.375
373.20	0.390
423.20	0.390
473.20	0.385

CURVE 12 (cont.)

T	k
523.20	0.375
573.20	0.370
623.20	0.360
673.20	0.355

CURVE 13

T	k
273.20	0.375
323.20	0.395
373.20	0.405
423.20	0.405
473.20	0.400
523.20	0.390
573.20	0.380
623.20	0.375
673.20	0.365
723.20	0.355
773.20	0.345
823.20	0.330
873.20	0.320
923.20	0.390
973.20	0.285
1023.20	0.255
1073.20	0.245
1123.20	0.250
1173.20	0.255

CURVE 14

T	k
303.20	0.222
323.20	0.222
373.20	0.226
473.20	0.230
573.20	0.247
673.20	0.259
773.20	0.276
873.20	0.293
973.20	0.305
1073.20	0.314
1173.20	0.314
1273.20	0.314

CURVE 15

T	k
303.20	0.201
323.20	0.205
373.20	0.209
473.20	0.226
573.20	0.247
673.20	0.268
773.20	0.280
873.20	0.293
973.20	0.297
1073.20	0.301
1173.20	0.301
1273.20	0.301

CURVE 16

T	k
303.20	0.243
323.20	0.247
373.20	0.255
473.20	0.272
573.20	0.297
673.20	0.318
773.20	0.331
873.20	0.335
973.20	0.335
1073.20	0.339
1173.20	0.339
1273.20	0.339
1373.20	0.339
1473.20	0.339

CURVE 17

T	k
303.20	0.264
323.20	0.261
373.20	0.261
473.20	0.264
573.20	0.289
673.20	0.297
773.20	0.310
873.20	0.326
973.20	0.335

CURVE 17 (cont.)

T	k
1073.20	0.347
1173.20	0.347
1273.20	0.347
1373.20	0.347

CURVE 18*

T	k
303.20	0.251
323.20	0.251
373.20	0.255
473.20	0.259
573.20	0.264
673.20	0.268
773.20	0.268
873.20	0.272
973.20	0.272
1073.20	0.272
1173.20	0.272
1273.20	0.272
1373.20	0.272

CURVE 19*

T	k
373.20	0.322
473.20	0.335
573.20	0.339
673.20	0.335
773.20	0.322
873.20	0.305
973.20	0.289

CURVE 20

T	k
373.20	0.377
473.20	0.377
573.20	0.368
673.20	0.347
773.20	0.331
873.20	0.310
973.20	0.293

CURVE 21*

T	k
373.20	0.272
473.20	0.272
573.20	0.276
673.20	0.276
773.20	0.276
873.20	0.276
973.20	0.276
1073.20	0.276

CURVE 22

T	k
373.20	0.177
473.20	0.188
573.20	0.199
673.20	0.210
773.20	0.221

CURVE 23*

T	k
273.20	0.464
373.20	0.439
473.20	0.415
573.20	0.392
673.20	0.369
773.20	0.344

CURVE 24

T	k
373.20	0.241
423.20	0.242
473.20	0.246
523.20	0.252
573.20	0.260
623.20	0.267
673.20	0.276
723.20	0.285
773.20	0.295

CURVE 25

T	k
273.20	0.423
323.20	0.427
373.20	0.427

CURVE 25 (cont.)

T	k
423.20	0.422
473.20	0.418
523.20	0.414
573.20	0.405
623.20	0.397

CURVE 26*

T	k
373.20	0.249
473.20	0.259
573.20	0.268
673.20	0.277

CURVE 27*

T	k
273.20	0.485
323.20	0.477
373.20	0.464
423.20	0.454
473.20	0.444
523.20	0.435
573.20	0.423

CURVE 28*

T	k
273.20	0.251
323.20	0.259
373.20	0.264
423.20	0.268
473.20	0.272
523.20	0.274
573.20	0.276

CURVE 29

T	k
473.20	0.194
573.20	0.208
673.20	0.220
773.20	0.234
873.20	0.247

CURVE 30*

T	k
303.20	0.345
353.20	0.350

CURVE 31*

T	k
323.20	0.415
373.20	0.410
423.20	0.410
473.20	0.405
573.20	0.395
673.20	0.375
773.20	0.355
873.20	0.325
973.20	0.300
1073.20	0.240

CURVE 32*

T	k
473.2	0.404
573.2	0.390
673.2	0.370
773.2	0.347

CURVE 33

T	k
340.4	0.0136
351.5	0.0151
371.5	0.0138
390.9	0.0149
412.1	0.0152
434.3	0.0160
453.2	0.0161
470.9	0.0163
485.4	0.0167
502.6	0.0169
518.7	0.0171
519.3	0.0164

* Not shown on plot

DATA TABLE NO. 329 (continued)

CURVE 33 (cont.)

T	k
524.3	0.0166
528.7	0.0170
529.8	0.0168*
535.9	0.0168
542.6	0.0170
555.4	0.0171
569.3	0.0177
591.5	0.0182
610.9	0.0180
630.9	0.0190

CURVE 34

T	k
390.4	0.00400
426.5	0.00427
460.9	0.00460
477.6	0.00533
500.4	0.00512
500.9	0.00488
502.1	0.00507*
504.8	0.00490*
509.8	0.00509*
514.8	0.00483
523.2	0.00524
532.1	0.00486

CURVE 35*

T	k
365.9	0.00292
412.1	0.00301
463.7	0.00341
498.2	0.00346
530.4	0.00367
533.7	0.00358
545.9	0.00355
552.6	0.00382
553.2	0.00358
556.5	0.00360*
563.2	0.00358
578.7	0.00398

CURVE 36*

T	k
673.2	0.3305

CURVE 37*

T	k
673.2	0.3138

CURVE 38

T	k
376.6	0.00323*
382.9	0.00340*
437.2	0.00362*
441.0	0.00340*
500.3	0.00370*
525.6	0.00352*
545.8	0.00390*
598.8	0.00456
598.9	0.00387
614.0	0.00425
622.3	0.00409
628.1	0.00425
674.6	0.00420
694.3	0.00425
694.8	0.00456
733.7	0.00470
792.8	0.00481
806.4	0.00474
845.4	0.00488

CURVE 39

T	k
397.0	0.00991
457.4	0.0107
525.6	0.0113
535.7	0.0113
621.6	0.0121

CURVE 40

T	k
432.2	0.00629
523.6	0.00661
647.3	0.00740
788.2	0.00811
837.7	0.00845

CURVE 41

T	k
463.9	0.00535
575.1	0.00551
699.5	0.00627
735.7	0.00695

CURVE 42

T	k
396.8	0.00758
444.8	0.00777
480.1	0.00777
530.6	0.00802
559.4	0.00834
569.5	0.00851
616.5	0.00851
627.1	0.00894
677.6	0.00909
680.6	0.00957
720.0	0.00944
740.2	0.00935
754.9	0.00987
770.5	0.00982
829.1	0.0101
848.8	0.0105

CURVE 43

T	k
391.8	0.0131
399.3	0.0132
432.7	0.0136
449.3	0.0137
465.5	0.0134
514.5	0.0144
528.1	0.0146
568.5	0.0154
574.8	0.0154
606.1	0.0159
607.4	0.0154
632.4	0.0158
654.4	0.0166
679.1	0.0170
684.1	0.0172
702.3	0.0176
722.6	0.0179

CURVE 44

T	k
473.2	0.228*
673.2	0.253
873.2	0.266

CURVE 45*

T	k
473.2	0.256

CURVE 45 (cont.)*

T	k
673.2	0.270
873.2	0.277

CURVE 46*

T	k
473.2	0.250
673.2	0.254
873.2	0.270

CURVE 47*

T	k
473.2	0.279
673.2	0.295
873.2	0.296

CURVE 48*

T	k
473.2	0.249
673.2	0.264
873.2	0.272

CURVE 49*

T	k
473.2	0.266
673.2	0.279
873.2	0.290

CURVE 50*

T	k
473.2	0.268
673.2	0.277
873.2	0.281

CURVE 51*

T	k
312.2	0.241
319.2	0.239
331.2	0.245
343.2	0.242
356.2	0.243
363.2	0.249
363.2	0.241
399.2	0.248
411.2	0.254
418.2	0.250
436.2	0.250

CURVE 52

T	k
321.2	0.245*
337.2	0.238
350.2	0.241
350.2	0.246*
365.2	0.251
375.2	0.242*
389.2	0.253
441.2	0.260
459.2	0.263

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* Not shown on plot

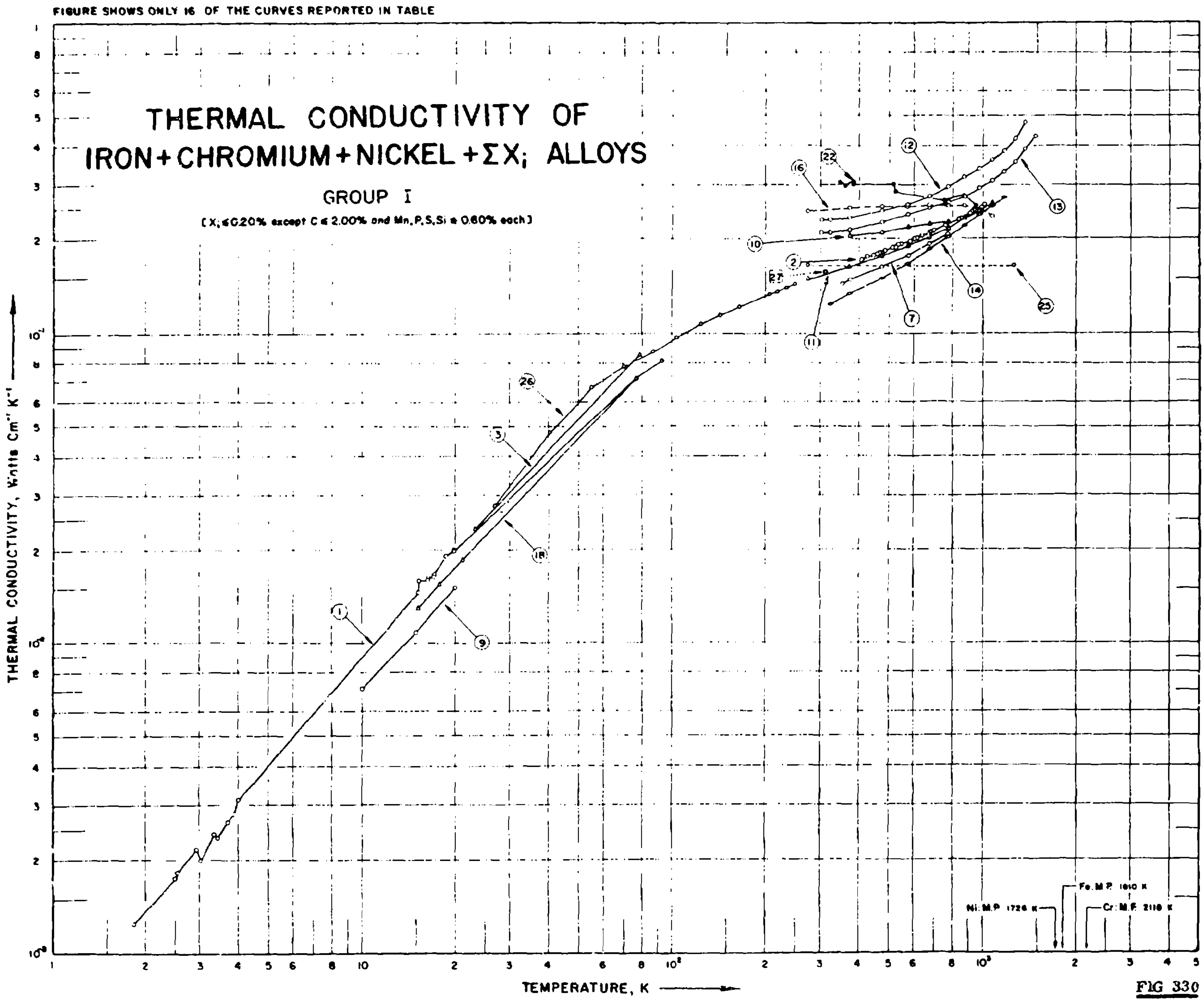


FIGURE SHOWS ONLY 16 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
IRON + CHROMIUM + NICKEL + ΣX; ALLOYS
GROUP I
[X; ≤ 0.20% except C ≤ 2.00% and Mn, P, S, Si ≤ 0.60% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Ni: M.P. 1726 K
Fe: M.P. 1810 K
Cr: M.P. 2118 K

FIG 330

SPECIFICATION TABLE NO. 330 THERMAL CONDUCTIVITY OF [IRON + CHROMIUM + NICKEL + ΣX_i] ALLOYS GROUP I

(X_i < 0.20% except C ≤ 2.00% and Mn, P, S, Si ≤ 0.60% each)

[For Data Reported in Figure and Table No. 330]

Curve No.	Ref. No.	Method Used	Year	Temperature Range, K	Reported Error, %	Name and Specimen Designation	Cr	Ni	C	Mn	Si	Composition (continued), Specifications and Remarks
1	157	L	1959	1.8- 93		3754	18.8	8.10	0.12	0.24	0.43	Quenched in water from 1150 C.
2	158	L	1955	406-1008		AISI 304 stainless	17.0/ 19.0	7.0/ 9.0	0.11			Nominal composition.
3	159	L	1952	23.79	< 10.0	AISI 304 stainless	17.0/ 19.0	7.0/ 9.0	0.11			Nominal composition.
4	129	C	1933	373- 788	3.0-5.0	A7	18.6	9.10	0.07	0.27		Heated to 735 C for 8 hrs and cooled in diatomaceous earth.
5	129	C	1933	373- 773	3.0-5.0	A8	18.5	9.23	0.11	0.19		Heated to 1120 C and quenched in cold water.
6	129	C	1933	373- 773	3.0-5.0	A9	19.6	8.96	0.24	0.37		Heated to 735 C for 8 hrs and cooled in diatomaceous earth.
7	129	C	1933	355- 773	3.0-5.0	A10	19.6	7.99	0.24	0.28		Heated to 1120 C and quenched in water.
8	161	C	1934	373- 773	2.0	A10A	19.6	7.99	0.24	0.28		The above specimen A10 heated again for 8 hrs at 735 C and cooled in furnace.
9	152	L	1949	10- 20		Stainless						Composition unknown.
10	160	F	1938	373- 773		AS21	27.0	18.0	0.32			Quenched
11	162	C	1936	273-1073		Staybrite	17.87	8.04	0.15	0.26	0.19	Softened at 1150 to 1200 C.
12	163	L	1936	303-1373		12	17.50	8.85	0.11	0.53	0.48	Rolled.
13	163	L	1936	303-1173		14	24.50	4.22	0.19	0.51	0.50	Rolled.
14	131	C	1953	323-1173	2.0	AISI 302 stainless	18.40	9.66	0.116		0.130	71.60 Fe, 0.021 P, 0.013 S, annealed at 1100 C.
15	129	C	1933	373- 773	3.0-5.0	A3	14.60	0.70	0.14	0.19	0.12	0.020 P, 0.015 S; annealed at 845 C.
16	162	C	1936	273-1073		F.H. stainless	13.65	0.37	0.27	0.29	0.27	Air hardened from 940 C and tempered at 725 C.
17	163	L	1936	303-1373		11	13.30	0.50	0.16	0.46	0.26	Rolled.
18	104	L	1951	15- 93		3754	18.80	8.10	0.12	0.24	0.43	Heated to 1150 C and quenched in oil.
19	539	L	1938	336-1056			17.30	8.61	0.26	0.30	0.20	0.017 P, 0.002 S; heated at 1100 C and quenched in water.
20	539	L	1938	326- 579			17.30	8.61	0.26	0.30	0.20	0.017 P, 0.002 S; heated at 1180 C and quenched in water.
21	539	L	1938	344-1052			17.30	8.61	0.26	0.30	0.20	0.017 P, 0.002 S; heated at 1180 C and quenched in water, then reheated to 306 C.
22	539	L	1938	348-1069			13.29	0.51	0.12	0.33	0.19	0.017 P, 0.016 S, annealed at 900 C and furnace cooled.
23	539	L	1938	331- 584			13.29	0.51	0.12	0.33	0.19	0.017 P, 0.016 S, water-quenched from 1180 C.
24	539	L	1938	340-1074			13.29	0.51	0.12	0.33	0.19	0.017 P, 0.016 S, water-quenched from 1180 C, and reheated to 310 C.
25	563	L	1935	273, 1273		Russian stainless	18.9	7.5	0.20	0.47	0.11	0.022 P.
26	565	L	1949	27- 250		18-8 type 304 stainless						Nominal composition.

SPECIFICATION TABLE NO. 330 (continued)

Curve No.	Ref. No.	Method Used	Year	Temperature Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight per cent) Cr	Ni	C	Mn	Si	Composition (continued), Specifications and Remarks
27	566	C	1956	313.2		18-8 stainless						Nominal composition.
28	439	L	1925	373-973	2.0	18-8 stainless	19.32	9.55	0.08	0.26	0.6	Heat-treated at 1050 C and water-quenched.
29	614	R	1961	435-1632	5	420 stainless	13.10	0.30	0.30	0.18	0.41	0.12 Cu, 0.06 Mo, 0.02 P and 0.011 S; specimen made up of 1 in. dia disks.

DATA TABLE NO. 330 THERMAL CONDUCTIVITY OF [IRON + CHROMIUM + NICKEL + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S, Si $\leq 0.60\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
1.84	0.00125
2.50	0.00175
2.54	0.00182
2.93	0.00217
3.03	0.00199
3.35	0.00241
3.43	0.00235
3.70	0.00264
3.88	0.00250
4.00	0.00311
15.17	0.0146
15.31	0.0159
16.29	0.0160
16.41	0.0163
17.08	0.0164
17.11	0.0168
18.68	0.0192
19.82	0.0208
19.83	0.0202
76.30	0.0714
92.80	0.0814

CURVE 2

T	k
405.90	0.172
423.20	0.176
444.10	0.178
457.20	0.179
463.20	0.181
473.20	0.181
483.20	0.184
512.20	0.188
523.20	0.188
534.20	0.192
547.80	0.193
583.70	0.197
599.60	0.199
614.30	0.201
637.80	0.205
670.50	0.207
676.70	0.210
695.00	0.212
757.70	0.220

CURVE 2 (cont.)

T	k
773.20	0.224
839.00	0.231
851.00	0.233
904.10	0.242
920.50	0.245
934.10	0.248
991.40	0.254
1008.00	0.259

CURVE 3

T	k
23.17	0.0234
78.77	0.0854

CURVE 4*

T	k
373.20	0.164
473.20	0.177
573.20	0.190
673.20	0.203
773.20	0.216
787.60	0.219

CURVE 5*

T	k
373.20	0.163
473.20	0.176
573.20	0.189
673.20	0.201
773.20	0.214

CURVE 6

T	k
373.20	0.156
473.20	0.172
573.20	0.187
673.20	0.202
773.20	0.217

CURVE 7

T	k
354.60	0.144
373.20	0.149

CURVE 7 (cont.)

T	k
473.20	0.164
573.20	0.178
673.20	0.193
773.20	0.207

CURVE 8*

T	k
373.20	0.150
473.20	0.166
573.20	0.181
673.20	0.196
773.20	0.212

CURVE 9

T	k
10.00	0.00711
15.00	0.0109
20.00	0.0151

CURVE 10

T	k
373.20	0.205
473.20	0.209
573.20	0.218
673.20	0.222
773.20	0.226

CURVE 11

T	k
273.20	0.149
373.20	0.163
473.20	0.176
573.20	0.188
673.20	0.205
773.20	0.218
873.20	0.234
973.20	0.247
1073.20	0.262

CURVE 12

T	k
303.20	0.230
323.20	0.230

CURVE 12 (cont.)

T	k
373.20	0.234
473.20	0.247
573.20	0.259
673.20	0.276
773.20	0.297
873.20	0.318
973.20	0.339
1073.20	0.360
1173.20	0.385
1273.20	0.423
1373.20	0.471

CURVE 13

T	k
303.20	0.209
323.20	0.209
373.20	0.213
473.20	0.226
573.20	0.239
673.20	0.251
773.20	0.264
873.20	0.276
973.20	0.293
1073.20	0.310
1173.20	0.331
1273.20	0.356
1373.20	0.389
1473.20	0.431

CURVE 14

T	k
323.20	0.123
373.20	0.133
473.20	0.151
573.20	0.168
673.20	0.186
773.20	0.204
873.20	0.221
973.20	0.239
1073.20	0.256
1173.20	0.274

CURVE 15*

T	k
373.20	0.243
473.20	0.247
573.20	0.252
673.20	0.256
773.20	0.261

CURVE 16

T	k
273.20	0.245
373.20	0.251
473.20	0.255
573.20	0.256
673.20	0.257
773.20	0.257
873.20	0.257
973.20	0.247
1073.20	0.236

CURVE 17*

T	k
303.20	0.222
323.20	0.222
373.20	0.222
473.20	0.226
573.20	0.230
673.20	0.234
773.20	0.239
873.20	0.243
973.20	0.251
1073.20	0.264
1173.20	0.280
1273.20	0.310
1373.20	0.335

CURVE 18

T	k
15.25	0.0129
17.90	0.0156
21.11	0.0187
76.30	0.0714
92.80	0.0814

CURVE 19*

T	k
338.2	0.207
350.2	0.205
375.2	0.211
511.2	0.200
580.2	0.205
662.2	0.207
754.2	0.216
883.2	0.236
992.2	0.249
1056.2	0.262

CURVE 20*

T	k
326.2	0.192
364.2	0.199
387.2	0.203
464.2	0.207
579.2	0.207

CURVE 21*

T	k
344.2	0.187
368.2	0.202
473.2	0.215
555.2	0.218
688.2	0.238
798.2	0.237
894.2	0.276
974.2	0.279
1052.2	0.270

CURVE 22

T	k
348.2	0.310
360.2	0.302
383.2	0.310
383.2	0.305
514.2	0.303
525.2	0.287
756.2	0.269
863.2	0.277*
959.2	0.254
1069.2	0.254*

CURVE 23*

T	k
331.2	0.254
382.2	0.263
462.2	0.267
584.2	0.259

CURVE 24*

T	k
340.2	0.267
380.2	0.279
493.2	0.268
572.2	0.279
657.2	0.278
796.2	0.256
868.2	0.252
987.2	0.273
1074.2	0.269

CURVE 25

T	k
273.2	0.167
1273.2	0.167

CURVE 26

T	k
26.8	0.0279
40.37	0.0474
55.20	0.0665
69.98	0.0782
87.26	0.0872
104.90	0.0971
125.03	0.107
144.77	0.114
165.12	0.121
206.54	0.132
219.94	0.135
235.09	0.140
250.10	0.144

CURVE 27

T	k
313.2	0.159

CURVE 28*

T	k
373.2	0.172
473.2	0.192
573.2	0.205
673.2	0.213
773.2	0.222
873.2	0.243
973.2	0.255

CURVE 29*

T	k
435.4	0.227
542.1	0.232
634.3	0.241
694.3	0.242
747.1	0.247
779.3	0.246
831.5	0.249
972.6	0.263
1037.1	0.265
1195.4	0.271
1319.3	0.286
1414.8	0.289
1505.4	0.290
1631.5	0.304

* Not shown on plot

FIGURE SHOWS ONLY 33 OF THE CURVES REPORTED IN TABLE

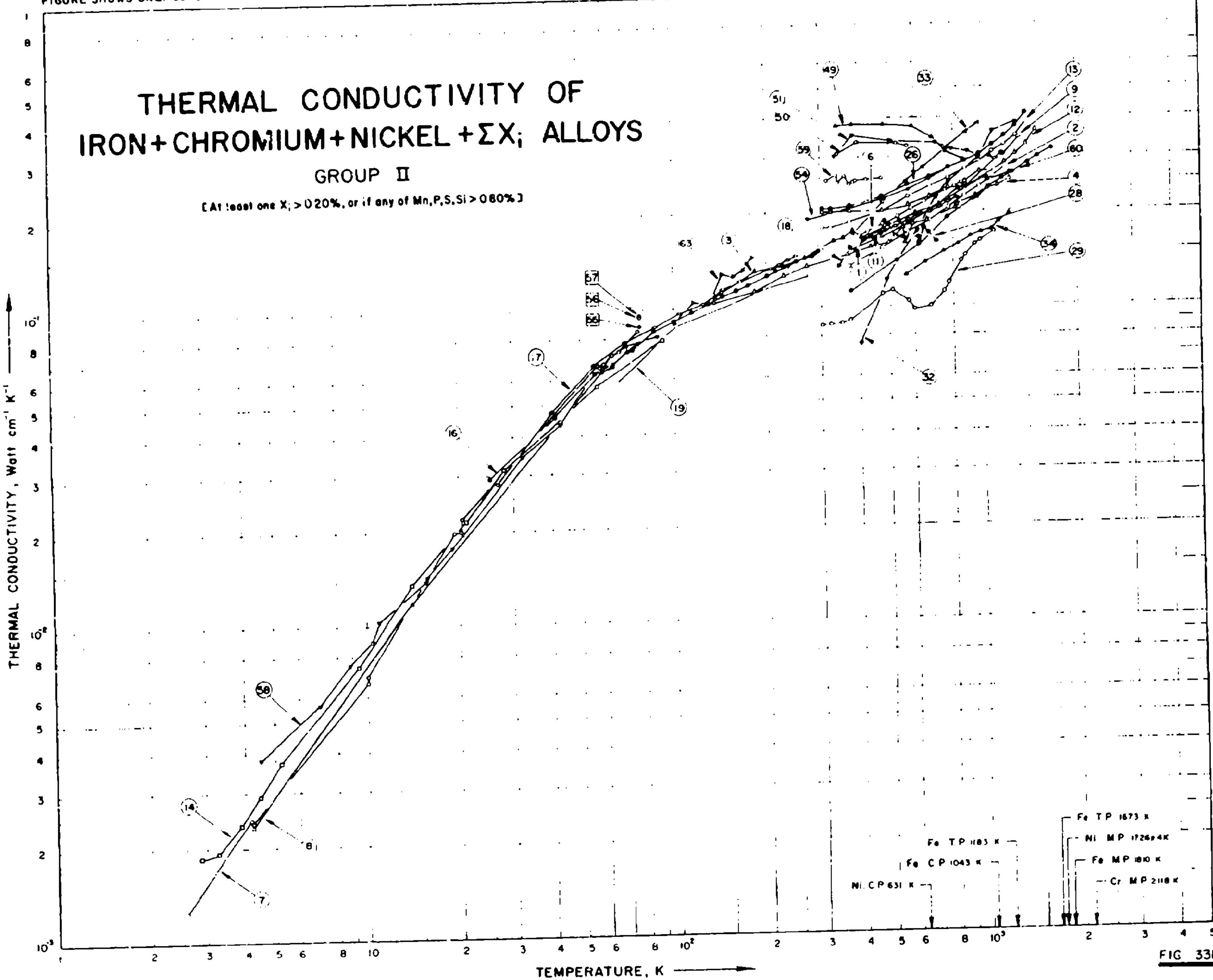


FIG. 331

SPECIFICATION TABLE NO. 331 THERMAL CONDUCTIVITY OF IRON + CHROMIUM + NICKEL + ΣX_i ALLOYS GROUP II

(At least one X_i > 0.20% or if any of Mn, P, S, Si > 0.60%)

[For Data Reported in Figure and Table No. 331]

Curve No.	Ref. No	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cr	Ni	C	Cu	Mn	Mo	P	Composition (continued), Specifications and Remarks
1	181	L	1953	373-1073		R 20	19.0	14.0	0.1		0.8			1.7 Nb, 0.3 Si.
2	181	L	1953	373-1173		G 18 B	13.0	13.0	0.4		0.8	2.0		10.0 Co, 3.0 Nb, 2.5 W, 1.0 Si.
3	91	C	1951	137-1217		AISI 301 stainless	16.0/ 18.0	6.0/ 8.0	0.08/ 0.20		2.0			Hot rolled; annealed at 1093 C for 1 hr.
4	91	C	1951	136-1220		AISI 316 stainless	16.82	11.66	0.108		1.59	2.18	0.018	0.26 Si, 0.023 S; hot rolled, annealed, and quenched in water.
5	91	C	1951	138-1174		AISI 347 stainless	17.65	10.94	0.06	0.09	1.64	0.02	0.013	0.73 Nb, 0.58 Si, 0.017 S; hot rolled, annealed, and quenched in water.
6	37	C	1957	400- 851	4.0	Multimet N-155	20.0	20.0	0.2			3.25		20.0 Co, 2.5 W, 1.1 Nb.
7	155	L	1951	2.6- 78		AISI 303 stainless	17.0/ 19.0	8.0/ 10.0	0.15 Max		2.0 Max	0.60 Max	0.07 Min	0.60 (Max) Zr, 0.07 (Min) Se, 0.07 S, Min.
8	155	L	1951	4.3- 76		AISI 347 stainless	17.0/ 19.0	9.0/ 12.0	0.08 Max					10 x C = Nb.
9	43	L	1958	877-1505	5.0	Stainless 17-7	17.30	7.06	0.074		0.60			72.21 Fe, 1.11 Al, 0.49 Si.
10	182	L	1959	373- 773	5.0	AISI 304 stainless	18.51	9.09	0.053		0.67		0.025	0.53 Si, 0.028 S.
11	182	L	1959	423- 823	5.0	AISI 304 stainless	18.51	9.09	0.053		0.67		0.025	0.53 Si, 0.028 S; tested in high vacuum.
12	163	L	1936	293-1473		17	12.85	12.23	0.48		1.44			2.88 W, 1.22 Si; usual heat treatment.
13	163	L	1936	303-1373		18	13.34	11.90	0.53		1.17			3.92 W, 1.07 Si; usual heat treatment.
14	9	L	1951	2.9- 92		Austenitic steel; 18/8	18.9	7.9	0.1					1.0 Ti, 0.7 Si.
15	38	L	1952	473- 923		AISI 304 stainless	18.0/ 20.0	8.0/ 11.0	0.08 Max		2.0 Max			
16	115	L	1951	25- 295		AISI 347 stainless	17.88	10.28	0.05	0.26	1.24			0.85 Nb, 0.57 Si, 0.027 N, 0.023 total P and S.
17	115	L	1951	27- 250		AISI 304 stainless	18.68	8.84	0.05	0.06	1.12			0.43 Si, 0.031 N, 0.04 total P and S.
18	687	R	1960	344-482	~5.0	AISI 304 stainless	18/ 20	8/ 12	0.08 Max		2.00 Max		0.045 Max	1.00 (Max) Si, 0.030 (Max) S; nominal composition; disklike specimen of 2.75 in. dia.; accuracy ± 0.008 W cm^{-1} C^{-1}.

SPECIFICATION TABLE NO. 331 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cr	Ni	C	Cu	Mn	Mo	P	Composition (continued), Specifications and Remarks
							Composition (weight percent)							
19	159	L	1953	66- 276	10.0	AISI 316 stainless	16.0/ 18.0	10.0/ 14.0	0.1			2.0/ 3.0		Annealed.
20	163	L	1936	303-1473		15	20.25	12.60	0.13		0.71			2.20 Si; rolled.
21	163	L	1936	303-1473		16	22.75	20.30	0.12		1.40			2.38 Si; rolled.
22	166	C	1939	273- 623		15	19.11	8.14	0.08	0.030	0.37		0.022	0.68 Si, 0.60 W, 0.025 As, 0.011 S, 0.004 Al; heated to 1100 C and cooled in water.
23	39	R	1973	333-1396	2.0	AISI 316 stainless	16.0/ 18.0	10.0/ 14.0	0.10 Max			2.0/ 3.0		
24	39	R	1958	330-1513	2.0	AISI 347 stainless	17.0/ 19.0	9.0/ 12.0	0.08 Max					10 x C = Nb.
25	161	C	1934	373- 773	2.0	A11	18.08	9.12	0.07		0.59		0.013	0.47 Si, 0.34 Ti, 0.003 S; annealed.
26	163	L	1936	303-1373		13	27.93	1.73	0.15		0.80			0.84; rolled.
27	193	L	1939	18- 290		EYA-2 steel	16.05	9.89	0.26		0.66		0.024	0.88 Si, 0.002 S; annealed at 1050 C for 2 hrs and quenched in water.
28	194	L	1951	469- 710	±5.0	AISI 347 stainless	18.00	11.12	0.07		1.77		0.016	0.88 Nb, 0.007 S.
29	175	P	1936	303-1073		Stainless steel	21.64	9.02	0.19	0.108	0.55		0.015	1.018 Si, 0.007 S; annealed at 850 C for 2.5 hrs.
30	177	C	1936	298.2	10.0	WF 100	13.82	13.10	0.54		1.03		0.006	2.89 Si, 1.54 W; forged.
31	195	C	1958	700, 1367	20.0	Stainless 17-7 PH	17.08	7.21	0.70		0.71		0.024	1.19 Al, 0.45 Si, 0.017 S; density 7.43 g cm^{-3}.
32	664	E	1957	400-1273	±4	Russian steel EI257	15	15	0.15		0.7	0.4	0.035	2.75 W, 0.8 Si, 0.030 S; specimen 4 mm dia and 120 mm long; austenitic; tempering at 1175 C (cooling medium is water) and aging at 750 C for 10 hrs.
33	664	E	1957	380- 963	±4	Russian steel Cr 19, Ni9	19	9						Other components unknown; specimen 4 mm dia and 120 mm long; austenitic; forging from 1150 C to 950 C, tempering at 1150 C (cooling medium is water) and aging at 700 C for 50 hrs.

SPECIFICATION TABLE NO. 331 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cr	Ni	C	Cu	Mn	Mo	P	Composition (continued), Specifications and Remarks
34	427	L	1960	561-1205		AISI 310 stainless	24.0/ 26.0	19.0/ 22.0	0.25 Max		2.0 Max			1.5 Si. Max.
35	534	E	1958	414- 713	3.0	18-8 stainless; YAIT-1	18	10	0.07		1.4			0.5 Ti, 0.4 Si; in form of rod.
36	534	E	1958	347- 928	3.0	18-8 stainless; YAIT-2	17.88	9.32	0.13		1.25			0.45 Si, 0.5 Ti; in form of rod.
37	534	E	1958	973.2	3.0	18-8 stainless; YAIT-3	18.6	8.0	0.10		1.25			0.5 Ti, 0.4 Si; in form of rod.
38	534	E	1958	448- 607	3.0	18-8 stainless; YAIT-4	17.2	10.0	0.12		1.21			0.49 Si, 0.5 Ti; in form of tube.
39	534	E	1958	448- 607	3.0	18-8 stainless; YAIT-5	17.79	9.8	0.1		1.74			0.46 Ti, 0.8 Si; in form of tube.
40	534	E	1958	442-1225	3.0	18-8 stainless; YAIT-6	19.0	9.8	0.09		1.27			0.54 Si, 0.46 Ti; from the melt.
41	534	E	1958	373- 973	3.0	18-8 stainless; EI-572	20.6	11.0	0.36		1.2	1.5		0.70 Si, 0.55 Ti, 0.3 Nb.
42	534	E	1958	373- 973	3.0	18-8 stainless; EI-572	20.0	11.0	0.36		1.2	1.5		0.70 Si, 0.55 Ti, 0.3 Nb; tempered at 700 C for 500 hrs.
43	534	E	1958	373- 973	3.0	18-8 stainless; EI-572	20.0	11.0	0.36		1.2	1.5		0.70 Si, 0.55 Ti, 0.3 Nb; tempered at 700 C for 1000 hrs.
44	534	E	1958	373- 973	3.0	18-8 stainless; EI-572	20.6	11.0	0.36		1.2	1.5		0.70 Si, 0.55 Ti, 0.3 Nb; tempered at 700 C for 2000 hrs.
45	534	E	1958	373- 973	3.0	18-8 stainless; EI-572	20.0	11.0	0.36		1.2	1.5		0.70 Si, 0.55 Ti, 0.3 Nb; tempered at 700 C for 1000 hrs.
46	534	F	1958	446- 973	3.0	18-8 stainless; EI 606, 1	18.0	8.0	0.09		1.0			2.0 W, 1.5 Si.
47	534	E	1958	440- 473	3.0	18-8 stainless; EI 606, 2	18.0	8.0	0.09		1.0			2.0 W, 1.5 Si.
48	534	E	1958	457- 779	3.0	18-8 stainless; EI 606, 3	18.0	8.0	0.09		1.0			2.0 W, 1.5 Si; aged at 310 C for 1000 hrs.
49	539	L	1938	340-1063		Ni-Cr steel	2.82	2.72	0.28		0.51	0.56	0.013	0.34 Si, 0.003 S; cooled in air from 900 C and tempered at 600 C.
50	539	L	1938	342- 571		Ni-Cr steel	2.82	2.72	0.28		0.51	0.56	0.013	0.34 Si, 0.003 S; quenched in oil from 850 C.

SPECIFICATION TABLE NO. 331 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cr	Ni	C	Cu	Mn	Mo	P	Composition (continued), Specifications and Remarks
51	539	L	1936	325 - 984		Ni - Cr steel	2.82	2.72	0.28		0.51	0.56	0.013	0.34 Si, 0.003 S; quenched in oil from 850 C and tempered at 300 C.
52	490	F	1950	273-1173		AISI 303 stainless	18.42	8.97	0.17		0.61			0.51 Si.
53	490	F	1950	273-1173		AISI 310 stainless	25.54	20.68	0.10		1.83		0.025	50.98 Fe, 0.84 Si, 0.005 S.
54	490	F	1950	273-1173		AISI 347 stainless	18.10	11.20	0.069		1.80		0.021	0.77 Nb, 0.76 Si, 0.007 S.
55	537		1940	78.2		18/8 stainless; 1	18.45	8.20	0.04					0.20 Ti; forged; commercial heat-resistant alloy; measured in the boiling nitrogen bath.
56	537		1940	78.2		18/8 stainless; 2	17.95	8.30	0.04					Forged; commercial heat-resistant alloy; measured in the boiling nitrogen bath.
57	537		1940	78.2		18/8 stainless; 3	17.80	9.19	0.04	1.56		3.00		Forged; commercial heat-resistant alloy; measured in the boiling nitrogen bath.
58	587, 154	L	1956	4.5-88	< 5.0	SS KH18N9T	17/20	8/11	0.14/Max		2.0/Max			Max 0.8 Sn, max 0.8 Ti, max 0.03 Si, max 0.035 S; unannealed.
59	615	C	1962	317-473		416 Stainless	12/14	1.25/2.50	0.15 Max		1.25 Max			1.00 Si max, min 0.15 S.
60	614	R	1961	375-1668	< 5	Ph17-4(H900) stainless	16.4	4.2	0.07	4.1	1.00		0.04	1.00 Si, 0.30 Nb + Ta; specimen composed of 5 one-inch dia disks.
61	614	R	1961	317-1623	< 5	AM355 stainless	15.66	4.27	0.12		0.94	2.82	0.02	0.05 Si, specimen composed of 5 one-inch dia disks.
62	614	R	1961	373-1498	< 5	Crucible HNM	18.5	9.5	0.30		3.50		0.23	0.05 Si, trace Mo, Al, and W; specimen composed of 5 one-inch dia disks.
63	685	L	1963	100-1[illegible]0		AISI 304 Stainless	18/20	8/12	0.08 Max		2.00 Max		0.045 Max	1.00 max Si, 0.030 max S; nominal composition; cross sectional area 0.105 cm^2 and 2.55 cm long.

SPECIFICATION TABLE NO. 331 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cr	Ni	C	Cu	Mn	Mo	P	Composition (continued), Specifications and Remarks
64	982	C	1965	274-1186	±5	AISI 316; 3A	17.45	12.60	0.063	0.09	1.59	2.55	0.023	0.60 Si, 0.19 Co, 0.010 S; machined specimen 0.900 ± 0.001 in. in dia, 5.715 ± 0.006 in. long in the measuring section and 1.125 ± 0.003 in. in dia and 3.375 ± 0.006 in. long in the heater section; hot-rolled, annealed and pickled; density 7.95 g cm^{-3} at 293.2 K; hardness, Rockwell B 78-79; measurements done in a vacuum of 2 x 10^{-5} Torr, electrical resistivity, during thermal conductivity measurements, 75.4, 80.1, 80.6, 83.9, 84.1, 85.5, 86.1, 86.3, 86.9, 90.0, 88.4, 90.8, 90.0, 92.3, 93.4, 95.2, 96.7, 98.2, 99.5, 100, 100, 104, 106, 105, 106, 109, 113, 111, 114, and 120 μohm cm at 273.7, 334.8, 343.7, 368.7, 391.5, 413.7, 417.6, 430.9, 431.5, 457.1, 460.9, 481.5, 500.9, 514.3, 520.4, 589.8, 605.4, 613.7, 659.3, 670.4, 679.8, 712.6, 722.1, 799.8, 800.4, 897.1, 958.2, 982.6, 1113.2, and 1185.9 K, respectively; electrical resistivity before thermal conductivity measurements 75.4 μohm cm at 295.9 K; Armco iron from Battelle Memorial Institute used as comparative material; specimen supplied by NASA-Lewis; results reported to be about 6-11% higher than values previously reported by BMI.

SPECIFICATION TABLE NO. 331 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cr	Ni	C	Cu	Mn	Mo	P	Composition (continued), Specifications and Remarks
65	982	C	1965	273-1219	±5	AISI 316; 4A	17.45	12.62	0.063		1.88	2.70	0.021	0.54 Si, 0.014 S; machined specimen 0.900 ±0.001 in. in dia, 5.715 ± 0.006 in. long in the measuring section and 1.125 ±0.003 in. in dia, 3.375 ±0.006 in. long in the heater section; hot-rolled, annealed and pickled; density 7.95 g cm^{-3} at 293.2 K; hardness, Rockwell B 77; measurements done in a vacuum of 2 x 10^{-6} Torr; electrical resistivity, during thermal conductivity measurements, 75.7, 80.3, 81.6, 82.7, 84.7, 86.0, 87.3, 87.5, 87.8, [illegible] 7, 91.5, 92.0, 93.1, 95. [illegible], 97.2, 99.0, 100, 102, 10[illegible], [illegible], 108, 108, 110, 114, 116, [illegible] and 112 μohm cm at 272.6, [illegible], 375.4, 394.3, 408.7, 433.7, [illegible], 439.5, 459.3, 472.6, 494.[illegible], 507.1, 558.2, 597.6, 600.9, 657.6, 662.6, 667.6, 703.7, 743.7, 792.1, 796.5, 822.1, 892.6, 952.6, 1012.1, 1140.9, and 1218.7 K respectively; electrical resistivity before thermal conductivity measurements 77.4 μohm cm at 294.3 K and after thermal conductivity measurements reported 78.6 μohm cm at 300.9 K; Armco iron from Battelle Memorial Institute used as reference material; specimen supplied by NASA-Lewis; results reported to be about 6-11% higher than the values previously reported by BMI.

DATA TABLE NO. 331 THERMAL CONDUCTIVITY OF [IRON + CHROMIUM + NICKEL + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si > 0.60%)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1} K^{-1}$]

T	k
CURVE 1	
373.20	0.151
473.20	0.167
573.20	0.184
673.20	0.201
773.20	0.218
873.20	0.234
973.20	0.251
1073.20	0.268
CURVE 2	
373.2	0.134
473.2	0.153
573.2	0.174
673.2	0.188
773.2	0.205
873.2	0.222
973.2	0.238
1073.2	0.257
1173.2	0.276
CURVE 3	
135.8	0.109
184.0	0.130
226.0	0.134
266.6	0.142
329.6	0.163
355.5	0.167
380.3	0.176
405.0	0.167
536.4	0.188
602.5	0.197
722.3	0.209
831.6	0.226
887.8	0.234
1032.4	0.255
1038.8	0.251
1216.7	0.264
CURVE 4	
135.7	0.105
184.4	0.113
228.9	0.126
270.0	0.134
367.5	0.146
433.8	0.155
482.1	0.151
497.8	0.159
552.5	0.180
560.9	0.159
592.5	0.184
660.7	0.188
759.8	0.201
812.6	0.205
825.6	0.209
944.7	0.222
953.8	0.218
1031.5	0.234
1114.0	0.238
1220.4	0.251
CURVE 5*	
137.7	0.117
185.4	0.130
228.6	0.142
269.2	0.146
361.9	0.151
427.9	0.159
429.5	0.167
490.8	0.167
540.7	0.184
550.1	0.176
552.1	0.167
576.5	0.188
662.3	0.188
741.5	0.205
768.9	0.201
801.0	0.213
CURVE 5	
919.1	0.234
996.9	0.234
1079.9	0.247
1173.6	0.259
CURVE 6	
400.4	0.170
422.0	0.174
477.6	0.184
533.2	0.194
588.7	0.204
644.3	0.214
699.8	0.222
755.4	0.231
810.9	0.238
851.0	0.245
CURVE 7	
2.59	0.00125
4.20	0.00247
4.25	0.00240
10.10	0.00663
10.10	0.00693
19.40	0.0198
20.40	0.0199
20.60	0.0220
56.90	0.0669
58.00	0.0657
58.30	0.0664
59.50	0.0672
59.70	0.0667
63.30	0.0719
66.80	0.0733
77.00	0.0843
77.60	0.0823
CURVE 8	
4.25	0.00234
14.00	0.0117
58.59	0.0638
63.20	0.0660
63.30	0.0670
70.70	0.0732
76.20	0.0772
CURVE 9	
876.8	0.237
880.1	0.235
1046.3	0.292
1156.7	0.305
1160.1	0.303
1309.2	0.331
1309.2	0.332
CURVE 10	
373.2	0.165
423.2	0.173
473.2	0.180
523.2	0.188
573.2	0.195
623.2	0.202
673.2	0.208
723.2	0.214
773.2	0.221
CURVE 11	
423.2	0.168
473.2	0.175
523.2	0.180
573.2	0.188
623.2	0.194
673.2	0.200
723.2	0.206
773.2	0.213
823.2	0.219
CURVE 12	
303.2	0.201
323.2	0.201
373.2	0.201
473.2	0.201
573.2	0.209
673.2	0.222
773.2	0.234
873.2	0.247
973.2	0.268
1073.2	0.268
1173.2	0.285
1273.2	0.305
1373.2	0.326
1473.2	0.360
CURVE 13	
303.2	0.180
323.2	0.180
373.2	0.188
473.2	0.201
573.2	0.222
673.2	0.239
773.2	0.255
873.2	0.272
973.2	0.289
1073.2	0.310
1173.2	0.326
1273.2	0.347
1373.2	0.385
CURVE 14	
2.88	0.00185
3.27	0.00192
3.86	0.00237
4.48	0.00292
5.23	0.00371
9.40	0.00742
14.10	0.0135
21.20	0.0216
CURVE 14 (cont.)	
28.80	0.0312
56.50	0.0575
92.00	0.0795
CURVE 15	
473.2	0.180
573.2	0.195
673.2	0.208
773.2	0.223
873.2	0.239
923.2	0.250
CURVE 16	
25.26	0.0293
41.10	0.0460
55.88	0.0628
70.89	0.0741
86.73	0.0841
100.23	0.0912
115.00	0.0975
129.89	0.104
145.48	0.110
160.16	0.114
175.11	0.118
201.62	0.126
214.42	0.130
234.94	0.134
249.73	0.139
282.10	0.145
287.90	0.148
294.72	0.150
CURVE 17	
26.74	0.0280
40.34	0.0473
55.18	0.0669
69.95	0.0778
87.28	0.0870
CURVE 17 (cont.)	
104.92	0.0970
125.06	0.107
144.81	0.114
165.15	0.121
206.64	0.132
220.02	0.135
235.13	0.140
250.10	0.144
CURVE 18	
344.3	0.134
372.1	0.155
388.7	0.151
410.9	0.163
415.4	0.165
445.4	0.167
482.1	0.176
CURVE 19	
65.72	0.0586
79.43	0.0711
102.70	0.0879
197.60	0.115
276.40	0.136
CURVE 20	
303.2	0.176
323.2	0.176
373.2	0.176
473.2	0.180
573.2	0.188
673.2	0.201
773.2	0.209
873.2	0.222
973.2	0.234
1073.2	0.247
1173.2	0.255
1273.2	0.268
1373.2	0.285
1473.2	0.305

* Not shown on plot

DATA TABLE NO. 331 (continued)

CURVE 21*

T	k
303.2	0.176
323.2	0.176
373.2	0.176
473.2	0.180
573.2	0.188
673.2	0.197
773.2	0.209
873.2	0.222
973.2	0.239
1073.2	0.255
1173.2	0.272
1273.2	0.289
1373.2	0.314
1473.2	0.339

CURVE 22*

T	k
273.2	0.159
323.2	0.161
373.2	0.163
423.2	0.167
473.2	0.172
523.2	0.178
573.2	0.182
623.2	0.188

CURVE 23*

T	k
333.2	0.138
372.2	0.141
433.0	0.155
478.2	0.163
600.6	0.170
837.3	0.199
1053.0	0.231
1304.4	0.273
1396.4	0.288

CURVE 24*

T	k
329.7	0.140
364.9	0.142
421.5	0.161
475.3	0.165
615.7	0.183

CURVE 24* (cont.)

T	k
826.1	0.211
1043.4	0.245
1284.6	0.278
1388.7	0.283
1542.9	0.300

CURVE 25*

T	k
373.2	0.161
473.2	0.176
573.2	0.191
673.2	0.206
773.2	0.221

CURVE 26

T	k
303.2	0.205
323.2	0.205
373.2	0.209
473.2	0.222
573.2	0.243
673.2	0.259
773.2	0.276
873.2	0.289
973.2	0.305
1073.2	0.326
1173.2	0.347
1273.2	0.372
1373.2	0.410

CURVE 27

T	k
18	0.0188
78	0.0824
290	0.469

CURVE 28

T	k
469.3	0.173
481.0	0.187
496.6	0.183
520.4	0.169
548.8	0.167
564.9	0.182
585.4	0.178

CURVE 28 (cont.)

T	k
617.1	0.166
622.1	0.160
643.2	0.177
669.3	0.173
709.9	0.160

CURVE 29

T	k
303.2	0.0870
323.2	0.0874
349.2	0.0883
373.2	0.0900
473.2	0.110
510.2	0.112
573.2	0.104
599.2	0.0979
673.2	0.100
746.2	0.111
773.2	0.118
846.2	0.138
873.2	0.144
939.2	0.156
973.2	0.161
1073.2	0.174

CURVE 30*

T	k
298.2	0.146

CURVE 31*

T	k
699.9	0.235
1366.5	0.273

CURVE 32

T	k
400.2	0.0753
489.2	0.121
610.2	0.176
703.2	0.222
776.3	0.247
878.0	0.272
974.2	0.295
1083.2	0.360
1272.5	0.383

CURVE 33

T	k
380.4	0.172
475.7	0.214
567.7	0.248
639.5	0.277
767.5	0.320
884.2	0.358
963.2	0.382

CURVE 34

T	k
561.2	0.126
647.2	0.137
746.2	0.149
822.2	0.158
907.2	0.168
979.2	0.172
1061.2	0.176
1120.2	0.186
1203.2	0.196

CURVE 35*

T	k
413.7	0.172
520.6	0.181
532.1	0.190
573.2	0.196
742.1	0.223
743.2	0.266

CURVE 36*

T	k
346.9	0.163
431.1	0.185
460.6	0.190
543.7	0.181
573.2	0.205
927.9	0.263

CURVE 37*

T	k
973.2	0.272

CURVE 38*

T	k
447.9	0.172
504.8	0.186
606.9	0.203

CURVE 39*

T	k
447.9	0.172
504.8	0.186
606.9	0.203

CURVE 40*

T	k
441.6	0.181
642.1	0.196
720.0	0.224
1037.4	0.278
1209.0	0.316
1224.8	0.306

CURVE 41*

T	k
373.2	0.138
573.2	0.176
773.2	0.215
973.2	0.251

CURVE 42*

T	k
373.2	0.178
573.2	0.201
773.2	0.234
973.2	0.273

CURVE 43*

T	k
373.2	0.176
573.2	0.205
773.2	0.238
973.2	0.278

CURVE 44*

T	k
373.2	0.169
573.2	0.195
773.2	0.228
973.2	0.270

CURVE 45*

T	k
373.2	0.172
573.2	0.195
773.2	0.232
973.2	0.272

CURVE 46*

T	k
446.6	0.158
585.1	0.182
973.2	0.241

CURVE 47*

T	k
439.6	0.145
566.9	0.177
843.3	0.220

CURVE 48*

T	k
457.1	0.147
601.2	0.183
778.8	0.203

CURVE 49

T	k
340.2	0.380
391.2	0.382
482.2	0.380
593.2	0.376
687.2	0.346
765.2	0.312
862.2	0.295
1061.2	0.301

CURVE 50

T	k
342.2	0.310
395.2	0.336
529.2	0.333
574.2	0.327

CURVE 51

T	k
335.2	0.302
382.2	0.352
504.2	0.339

CURVE 51 (cont.)

T	k
706.2	0.334
793.2	0.318
895.2	0.312
984.2	0.299

CURVE 52*

T	k
273.2	0.142
373.2	0.151
473.2	0.159
573.2	0.176
673.2	0.197
773.2	0.213
873.2	0.230
973.2	0.247
1073.2	0.268
1173.2	0.28[illegible]

CURVE 53*

T	k
273.2	0.130
373.2	0.142
473.2	0.163
573.2	0.184
673.2	0.201
773.2	0.226
873.2	0.251
973.2	0.276
1073.2	0.301
1173.2	0.326

CURVE 54

T	k
273.2	0.192
373.2	0.205
473.2	0.222
573.2	0.234
673.2	0.255
773.2	0.276
873.2	0.293
973.2	0.314
1073.2	0.339
1173.2	0.364

CURVE 55

T	k
78.2	0.0879

* Not shown on plot

DATA TABLE NO. 331 (continued)

T	k
CURVE 56	
78.2	0.0941
CURVE 57	
78.2	0.0950
CURVE 58	
4.50	0.00380
7.00	0.00569
8.80	0.00753
10.40	0.00996
11.00	0.0103
15.60	0.0138
15.70	0.0142
19.00	0.0177
20.70	0.0197
32.20	0.0343
43.00	0.0435
60.00	0.0678
70.00	0.0762
88.50	0.0816
CURVE 59	
316.5	0.251
338.7	0.262
340.4	0.246
359.8	0.260
372.1	0.244
384.3	0.248
388.7	0.251
422.1	0.252
473.2	0.254
CURVE 60	
375.4	0.113
528.2	0.138
618.7	0.158
765.4	0.191
930.4	0.219
1039.3	0.236
1162.6	0.253
CURVE 60 (cont.)	
1243.7	0.263
1405.9	0.285
1503.2	0.297
1668.2	0.315
CURVE 61*	
316.5	0.154
407.1	0.167
514.3	0.178
633.7	0.191
795.4	0.210
967.6	0.238
1131.5	0.257
1172.6	0.263
1336.5	0.280
1562.6	0.296
1623.2	0.305
CURVE 62	
372.6	0.152
498.2	0.172
627.1	0.200
803.7	0.229
958.7	0.263
1037.1	0.278
1170.4	0.293
1339.3	0.326
1457.1	0.343
1498.2	0.348
CURVE 63	
100	0.090
116	0.106
131	0.105
144	0.128
156	0.126
168	0.132
180	0.145
CURVE 64*	
273.7	0.130
334.8	0.142
CURVE 64 (cont.)*	
343.7	0.146
388.7	0.154
391.5	0.154
413.7	0.158
417.6	0.157
430.9	0.165
431.5	0.159
457.1	0.163
460.9	0.165
481.5	0.171
500.9	0.173
514.3	0.175
520.4	0.175
589.8	0.189
605.4	0.190
613.7	0.189
659.3	0.196
670.4	0.195
679.8	0.199
712.6	0.200
722.1	0.204
799.8	0.221
800.4	0.220
897.1	0.236
958.2	0.244
982.6	0.246
1113.2	0.265
1185.9	0.277
CURVE 65*	
272.6	0.133
335.4	0.146
346.5	0.148
375.4	0.157
394.3	0.157
408.7	0.154
433.7	0.166
438.2	0.160
439.8	0.165
459.3	0.170
472.6	0.169
494.3	0.170
507.1	0.170
558.2	0.179
597.6	0.182
CURVE 65 (cont.)*	
600.9	0.187
657.6	0.192
662.6	0.192
667.6	0.194
703.7	0.196
743.7	0.211
792.1	0.208
796.5	0.211
822.1	0.223
892.6	0.228
952.6	0.237
1012.1	0.251
1140.9	0.282
1218.7	0.291

* Not shown on plot

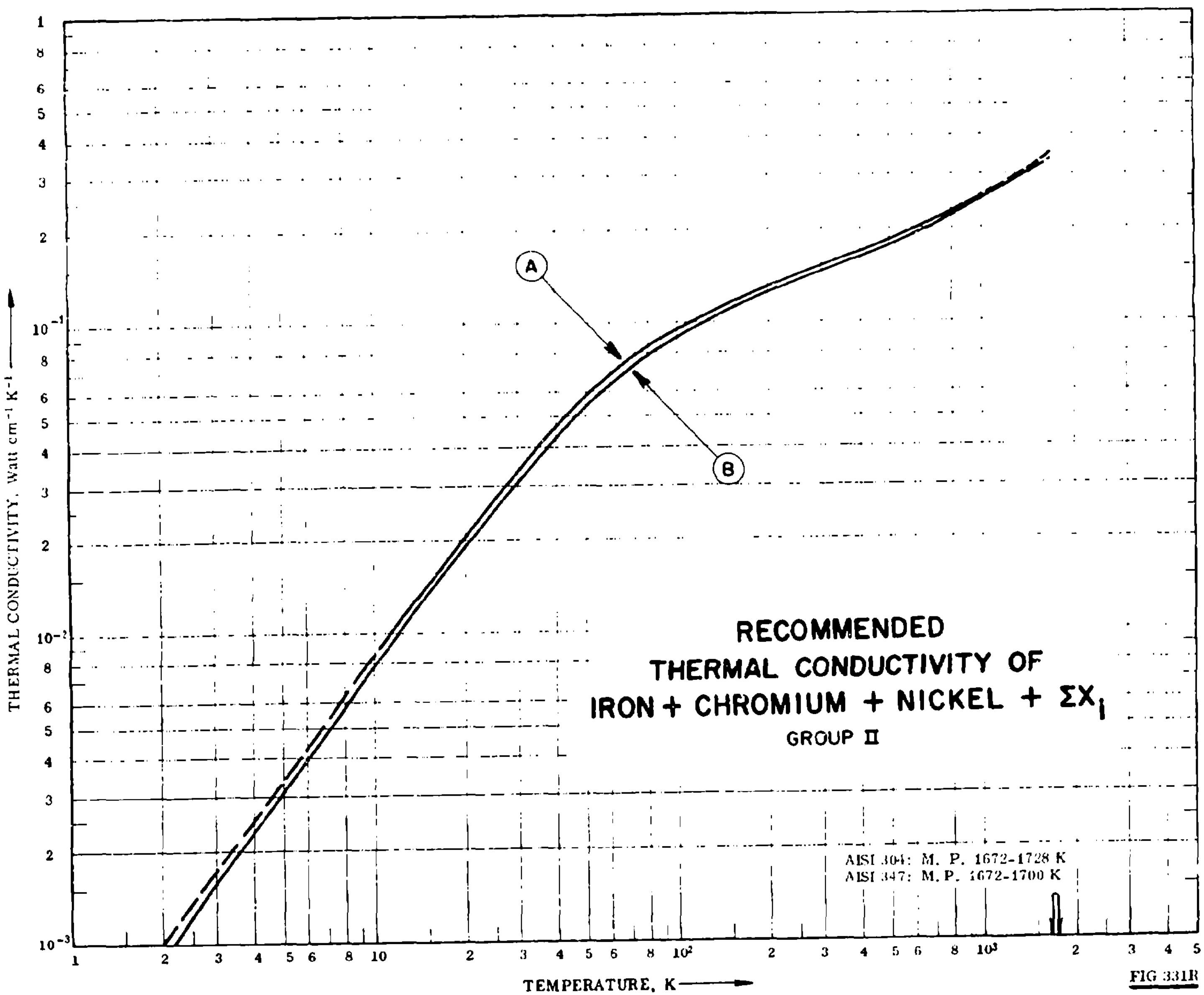

RECOMMENDED
THERMAL CONDUCTIVITY OF
IRON + CHROMIUM + NICKEL + ΣX_i
GROUP II
AISI 304: M. P. 1672-1728 K
AISI 347: M. P. 1672-1700 K
A
B
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
8
6
5
4
3
2
10⁻¹
10⁻²
10⁻³
10
10²
10³

FIG 331R

SPECIFICATION TABLE NO. 331R RECOMMENDED THERMAL CONDUCTIVITY OF [IRON + CHROMIUM + NICKEL + ΣX_i] GROUP II

[For Data Reported in Figure and Data Table No. 331R]

Curve No.	Name and Designation	Nominal Composition (weight percent) and Remarks	Estimated Error
A	Stainless steel 304	18.00-20.00 Cr, 8.00-12.00 Ni, 2.00(max)Mn, 1.00(max)Si, and 0.08(max)C.	±10% below 100 K, ± 5% from 300 to 800 K, and ± 10% above 1400 K.
B	Stainless steel 347	17.00-19.00 Cr, 9.00-13.00 Ni, 2.00(max)Mn, 1.00(max)Si, 0.08 (max)C, and 10 x C(min)Nb-Ta.	Same as above.

DATA TABLE NO. 331R RECOMMENDED THERMAL CONDUCTIVITY OF [IRON + CHROMIUM + NICKEL + ΣX_i] GROUP II

[Temperature, T_1 in K and T_2 in F; Thermal Conductivity, k_1 in Watt $cm^{-1} K^{-1}$ and k_2 in Btu $hr^{-1} ft^{-1} F^{-1}$]

CURVE A

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.00039)‡	(0.0225)	-457.9
5	(0.0034)	(0.196)	-450.7
10	(0.0085)	(0.491)	-441.7
25	0.027	1.56	-414.7
50	0.058	3.35	-369.7
75	0.080	4.62	-324.7
100	0.095	5.49	-279.7
150	0.115	6.64	-189.7
200	0.130	7.51	- 99.7
250	0.142	8.20	- 9.7
273.2	0.147	8.49	32.0
300	0.152	8.78	80.3
350	0.162	9.36	170.3
400	0.170	9.82	260.3
450	0.177	10.2	350.3

CURVE A (cont.)

T_1	k_1	k_2	T_2
500	0.184	10.6	440.3
600	0.198	11.4	620.3
700	0.212	12.2	800.3
800	0.225	13.0	980.3
900	0.239	13.8	1160
1000	(0.253)	(14.6)	1340
1100	(0.267)	(15.4)	1520
1200	(0.281)	(16.2)	1700
1300	(0.295)	(17.0)	1880
1400	(0.309)	(17.9)	2060
1500	(0.323)	(18.7)	2240
1600	(0.337)	(19.5)	2420
1665	(0.347)	(20.0)	2537

CURVE B

T_1	k_1	k_2	T_2
0	0	0	-459.7
1	(0.00035)	(0.0202)	-457.9
5	0.0031	0.179	-450.7
10	0.0078	0.451	-441.7
25	0.025	1.44	-414.7
50	0.054	3.12	-369.7
75	0.076	4.39	-324.7
100	0.091	5.26	-279.7
150	0.111	6.41	-189.7
200	0.126	7.28	- 99.7
250	0.138	7.97	- 9.7
273.2	0.143	8.26	32.0
300	0.148	8.55	80.3
350	0.157	9.07	170.3
400	0.165	9.53	260.3
450	0.172	9.94	350.3

CURVE B (cont.)

T_1	k_1	k_2	T_2
500	0.179	10.3	440.3
600	0.192	11.1	620.3
700	0.205	11.8	800.3
800	0.219	12.7	980.3
900	0.232	13.4	1160
1000	0.246	14.2	1340
1100	0.259	15.0	1520
1200	0.273	15.8	1700
1300	0.286	16.5	1880
1400	0.300	17.3	2060
1500	0.313	18.1	2240
1600	(0.327)	(18.9)	2420
1665	(0.336)	(19.4)	2537

‡ Values in parentheses are extrapolated.

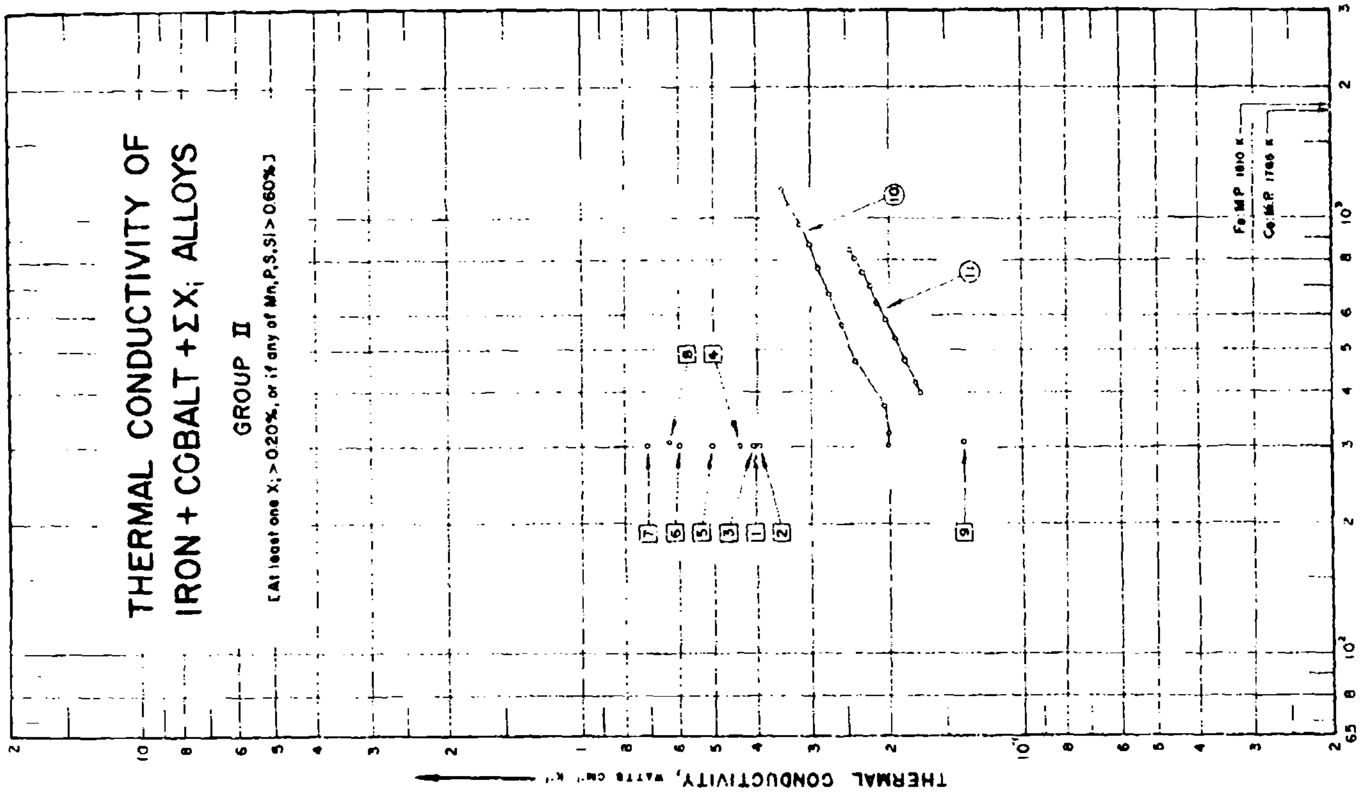

THERMAL CONDUCTIVITY OF
IRON + COBALT + ΣXi ALLOYS
GROUP II
[At least one Xi > 0.20%, or if any of Mn,P,S,Si > 0.60%]
1
2
3
4
5
6
7
8
9
10
11
Fe: M.P. 1810 K
Co: M.P. 1765 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹

FIG 332

SPECIFICATION TABLE NO. 332 THERMAL CONDUCTIVITY OF [IRON + COBALT + ΣX_i] ALLOYS GROUP II

(At least one X_i >0.20% or if any of Mn, P, S, Si >0.60%)

[For Data Reported in Figure and Table No. 332]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Co	C	Cr	Cu	Mn	Ni	P	S	Si	Composition (continued), Specifications and Remarks
1	208	E	1919	303.2		2	4.86	0.098		0.27	0.295	0.06	0.029	0.025	0.11	
2	208	E	1919	303.2		3	9.71	0.105		0.26	0.279	0.11	0.027	0.023	0.11	
3	208	E	1919	303.2		4	14.6	0.115		0.25	0.264	0.17	0.026	0.022	0.12	
4	208	E	1919	303.2		5	19.4	0.12		0.23	0.248	0.22	0.024	0.021	0.12	
5	208	E	1919	303.2		6	29.1	0.135		0.20	0.217	0.33	0.021	0.018	0.12	
6	208	E	1919	303.2		7	38.3	0.15		0.17	0.186	0.44	0.018	0.015	0.12	
7	208	E	1919	303.2		8	48.6	0.165		0.14	0.155	0.55	0.015	0.013	0.125	
8	172	E	1927	309.2		K.S. Magnet steel	35.0/ 41.0	0.90	3.50/ 5.75		0.30/ 0.85					3.75-7.0 W; annealed at 1080 C and slowly cooled.
9	172	E	1927	309.2		K.S. Magnet steel	35.0/ 41.0	0.90	3.50/ 5.75		0.30/ 0.85					3.75-7.0 W; heated to 900 C for 30 min and quenched in oil, then requenched from 950 C.
10	163	L	1936	303-1173		10	26.00	0.07	20.47		0.42				0.51	Forged.
11	37	C	1951	409-851	4.0	Haynes alloy N-155	20.00	0.2	20.00			20.0				2.5 W, 1.0 Nb, 3.25 Mo.

DATA TABLE NO. 332 THERMAL CONDUCTIVITY OF [IRON + COBALT + ΣX_i] ALLOYS GROUP II

(At least one X_i > 0.20% or if any of Mn, P, S, Si > 0.60%)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
303.20	0.402
CURVE 2	
303.20	0.395
CURVE 3	
303.20	0.409
CURVE 4	
303.20	0.438
CURVE 5	
303.20	0.503
CURVE 6	
303.20	0.598
CURVE 7	
303.20	0.711
CURVE 8	
309.20	0.634
CURVE 9	
309.20	0.137
CURVE 10	
303.20	0.201
323.20	0.201
373.20	0.205
473.20	0.219
573.20	0.255
673.20	[illegible]
CURVE 10 (cont.)	
773.20	0.289
873.20	0.301
973.20	0.318
1073.20	0.335
1173.20	0.347
CURVE 11	
400.40	0.170
422.00	0.174
477.60	0.184
533.20	0.194
588.70	0.204
644.30	0.214
699.80	0.222
755.40	0.231
810.90	0.238
851.00	0.245

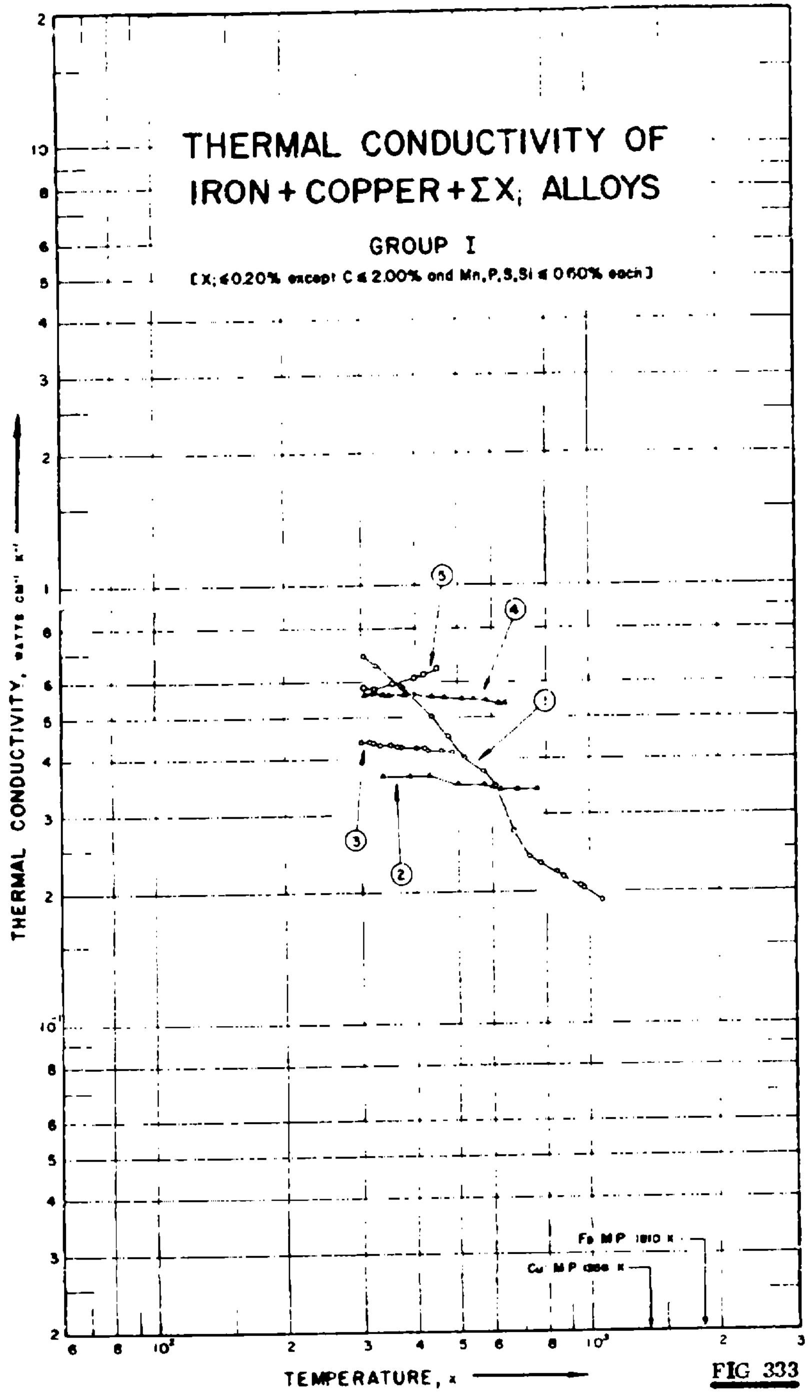

THERMAL CONDUCTIVITY OF
IRON + COPPER + ΣX_i ALLOYS
GROUP I
[X_i ≤ 0.20% except C ≤ 2.00% and Mn,P,S,Si ≤ 0.60% each]
THERMAL CONDUCTIVITY, WATTS CM⁻¹ K⁻¹
TEMPERATURE, K
Fe M.P. 1810 K
Cu M.P. 1356 K

FIG 333

SPECIFICATION TABLE NO. 333 THERMAL CONDUCTIVITY OF [IRON + COPPER + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.90\%$ and Mn, P, S, Si $\leq 0.60\%$ each)

[For Data Reported in Figure and Table No. 333]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Cu	C	Mn	P	S	Si	Composition (continued), Specifications and Remarks
1	173	P	1936	303-1073		Carbon steel	0.638	0.22	0.38	0.041	0.067	0.030	Annealed at 850 C for 2.5 hrs.
2	192	E	1954	335-762			5.0	1.66	0.44			0.35	FeO + Fe_2O_3 = 6.30, porosity = 17%; without heat treatment.
3	192	E	1954	293-485			10.54	1.6	0.42			0.29	Porosity = 10%; without heat treatment.
4	192	E	1954	395-646			19.86	1.52	0.39			0.31	Porosity = 10.5%; without heat treatment.
5	192	E	1954	305-448			40.69	1.51	0.40			0.29	Porosity = 10.7%; without heat treatment.

DATA TABLE NO. 333 THERMAL CONDUCTIVITY OF [IRON + COPPER + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S, Si $\leq 0.60\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
303.20	0.688
323.20	0.654
370.20	0.587
373.20	0.583
435.20	0.501
473.20	0.451
500.20	0.418
573.20	0.374
612.20	0.346
673.20	0.275
730.20	0.239
773.20	0.231
841.20	0.220
873.20	0.215
954.20	0.206
973.20	0.203
1073.20	0.190
CURVE 2	
335.40	0.364
388.30	0.364
430.50	0.364
501.10	0.347
576.50	0.347
601.00	0.343
628.20	0.339
684.70	0.339
761.70	0.339
CURVE 3	
298.40	0.439
312.20	0.439
319.10	0.435
330.50	0.431
350.00	0.431
350.20	0.431
363.20	0.427
381.40	0.427
401.50	0.423
420.40	0.423
CURVE 3 (cont.)	
426.70	0.418
458.90	0.418
484.60	0.414
CURVE 4	
304.70	0.561
317.60	0.565
336.10	0.561
347.20	0.561
377.70	0.561
398.40	0.561
436.20	0.556
468.50	0.552
512.40	0.548
544.20	0.548
581.20	0.544
621.10	0.536
646.20	0.536
CURVE 5	
304.80	0.582
320.90	0.577
354.20	0.594
397.20	0.611
417.90	0.623
448.20	0.640

FIGURE SHOWS ONLY 41 OF THE CURVES REPORTED IN TABLE

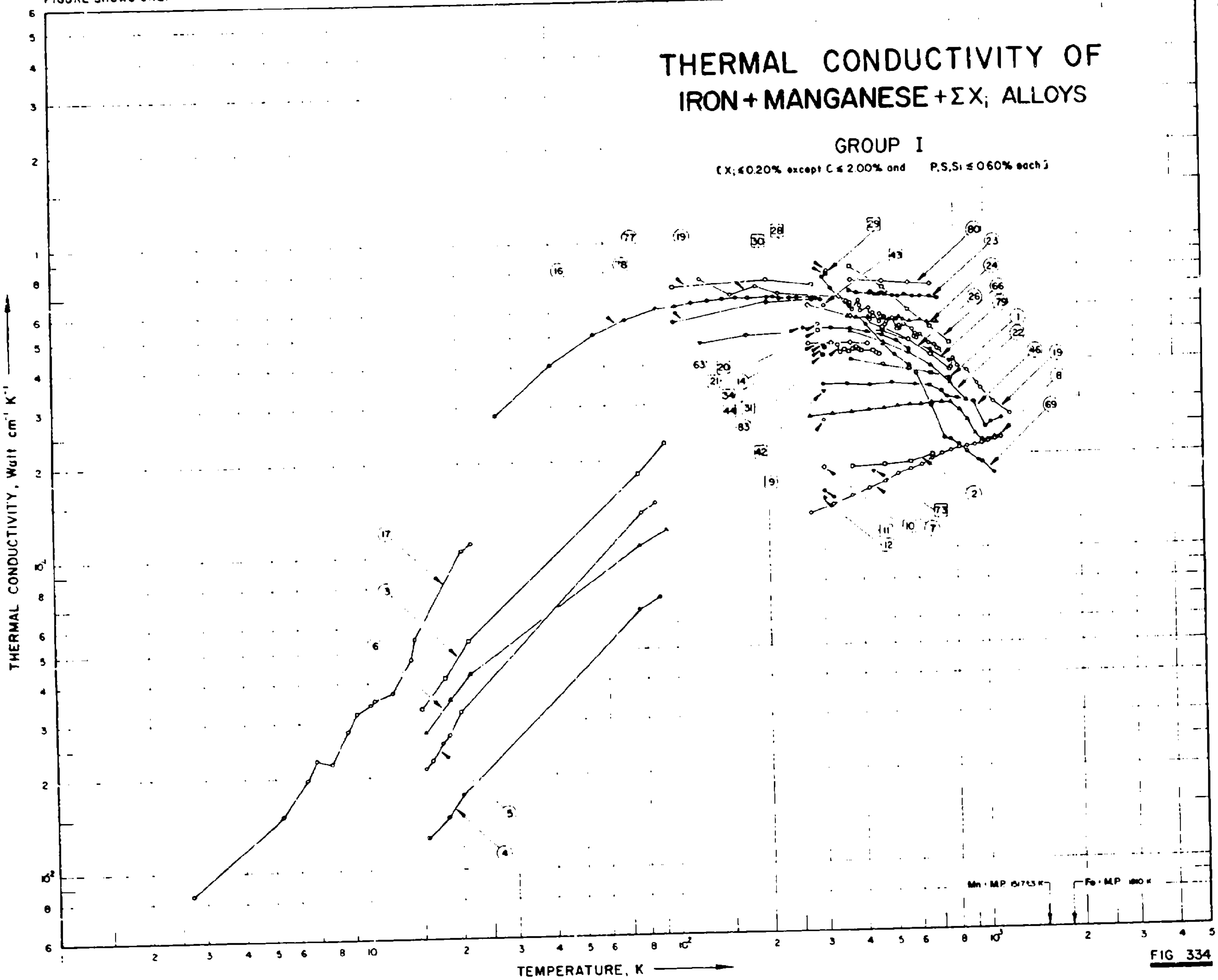


FIG 334

SPECIFICATION TABLE NO. 334 THERMAL CONDUCTIVITY OF (IRON + MANGANESE + ΣX_i) ALLOYS GROUP I

($X_i \leq 0.20\%$ except $C \leq 2.00\%$ and P, S, Si $\leq 0.60\%$ each)

[For Data Reported in Figure and Table No. 334]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Mn	Al	C	Cr	Cu	Ni	P	S	Si	Composition (continued), Specifications and Remarks
1	129	C	1933	373- 773	3.0-5.0	Low Mn steel	1.65		0.51			0.10	0.016	0.023	0.24	Normalized at 900 C.
2	160	F	1938	373- 573		Austenitic steel	13.50		1.12							Nominal composition; austenitic.
3	104	L	1951	15- 93		53	2.23		0.41						0.07	Heated to 800 C and cooled in furnace.
4	104	L	1951	16- 88		1010	12.69		1.27						0.12	Heated to 1000 C and quenched in water.
5	104	L	1951	15- 86		1379 E	12.95		0.09				0.050	0.103	0.12	Heated to 1000 C and quenched in water.
6	104	L	1951	15- 93		1379 H	38.9		0.20				0.36	0.055	0.70	Heated to 1000 C and quenched in water.
7	164	C	1946	273-1123		13	13.0	0.004	1.22	0.03	0.070	0.07	0.038	0.010	0.22	0.038 As; heated to 1050 C and cooled in air.
8	164	C	1946	273-1123		G	13.0	0.004	1.22	0.03	0.070	0.07	0.039	0.010	0.22	0.038 As, heated to 1050 C and air cooled, then heat-treated at 450 C for 102 days.
9	165	E	1919	303.2		8	5.0	0.056	0.202				0.049	0.039	0.072	
10	165	E	1919	303.2		9	5.0	0.095	0.199				0.047	0.038	0.080	
11	165	E	1919	303.2		10	7.9	0.152	0.195				0.046	0.037	0.092	
12	165	E	1919	303.2		11	8.8	0.170	0.194				0.046	0.036	0.096	
13	165	E	1919	303.2		12	9.8	0.189	0.192				0.045	0.036	0.10	
14	166	C	1939	273- 423		4	1.50	0.015	0.23	0.06	0.105	0.04	0.037	0.038	0.12	0.033 As; 0.025 Mo; annealed at 860 C.
15	166	C	1939	273- 623		13	13.0	0.004	1.22	0.03	0.070	0.07	0.038	0.010	0.22	0.038 As; heated to 1050 C and cooled in air.
16	115	L	1951	27- 299		SAE 1020 steel	0.33		0.18						0.014	
17	81	L	1939	2.7- 22			0.50 0.70		0.4				0.03	0.03	0.20 0.35	
18	17	L	1958	293- 353	1.0	42.11 C steel	0.68		0.31				0.021	0.034	0.28	
19	91	C	1951	123-1198		SAE 1010 steel	0.42		0.10				0.008	0.28		Hot rolled.
20	167		1935	293.2			≈0.5		0.10						≈0.2	
21	167		1935	293.2			≈0.5		0.3						≈0.2	
22	168	L	1932	373- 873	5.0		0.5		0.12	0.05			0.05	0.05	0.12	
23	31	L	1933	370- 710	2.0	CS 1	0.34		0.10				0.031	0.041	[illegible]	Normalized at 900 C.
24	31	L	1933	366- 705	2.0	CS 2	0.61		0.26				0.025	0.053	[illegible]	Normalized at 900 C.
25	31	L	1933	365- 706	2.0	CS 3	0.67		0.44				0.024	0.037	[illegible]	Normalized at 900 C.
26	169	R	1936	273- 773		Steel 1	0.17		0.004						0.02	
27	169	R	1936	273- 536		Steel 2	0.37		0.10						0.17	
28	170	L	1926	313.2		1.1	0.13		0.08				0.009	0.005	0.03	Annealed.
29	170	L	1926	313.2		1.2	0.13		0.08				0.009	0.005	0.03	Forged.
30	170	L	1926	313.2		1.3 h	0.13		0.08				0.009	0.005	0.03	Annealed, and then quenched from 800 C.

SPECIFICATION TABLE NO. 334 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation Fe	Composition (weight per cent) Mn	Al	C	Cr	Cu	Ni	P	S	Si	Composition(continued), Specifications and Remarks
31	171	E	1917	303.2		Krupp steel, 2a	0.39		0.14		0.10		0.015	0.030	0.31	Forged.
32	171	E	1917	303.2		Krupp steel, 2b	0.39		0.14		0.10		0.015	0.030	0.31	Annealed in vacuum at 900 C for 1 hr.
33	171	E	1917	303.2		Krupp steel, 2c	0.39		0.14		0.10		0.015	0.030	0.31	Quenched in oil from 900 C.
34	171	E	1917	303.2		Krupp steel, 4a	0.34		0.18		0.10		0.051	0.044	0.10	Forged.
35	171	E	1917	303.2		Krupp steel, 4b	0.34		0.18		0.10		0.051	0.044	0.10	Annealed at 900 C for 1 hr in vacuum.
36	171	E	1917	303.2		Krupp steel, 4c	0.34		0.18		0.10		0.051	0.044	0.10	Quenched in oil from 900 C.
37	171	E	1917	303.2		Krupp steel, 6a	0.65		0.31		0.13		0.013	0.028	0.23	Forged.
38	171	E	1917	303.2		Krupp steel, 6b	0.65		0.31		0.13		0.013	0.028	0.23	Annealed at 900 C for 1 hr in vacuum.
39	171	E	1917	303.2		Krupp steel, 6c	0.65		0.31		0.13		0.013	0.028	0.23	Quenched in oil from 900 C.
40	171	E	1917	303.2		Krupp steel, 8a	0.67		0.44		0.09		0.043	0.043	0.34	Forged.
41	171	E	1917	303.2		Krupp steel, 8b	0.67		0.44		0.09		0.043	0.043	0.34	Annealed at 900 C for 1 hr in vacuum.
42	171	E	1917	303.2		Krupp steel, 8c	0.67		0.44		0.09		0.043	0.043	0.34	Quenched in oil from 300 C.
43	172	E	1927	307.2		1	0.38		0.095				0.021	0.021	Trace	
44	172	E	1927	307.2		2	0.43		0.395				0.023	0.021	0.33	
45	71	L	1917	303-1199		4	0.34		0.18		0.10		0.051	0.044	0.10	Forged.
46	71	L	1917	303-1135		8	0.67		0.44		0.09		0.043	0.043	0.34	Forged.
47	173	C	1956	323-1123		En 8a	1.05		0.39			0.12	0.032	0.043	0.14	Normalized.
48	173	C	1956	323, 373		En 8b	1.05		0.39			0.12	0.032	0.043	0.14	Quenched in oil from 850 C.
49	173	C	1956	323, 373		En 8c	1.05		0.39			0.12	0.032	0.043	0.14	Tempered 3 hrs at 150 C after being quenched in oil from 850 C.
50	173	C	1956	323- 473		En 8d	1.05		0.39			0.12	0.032	0.043	0.14	Tempered 3 hrs at 350 C after being quenched in oil from 850 C.
51	173	C	1956	323- 473		En 8e	1.05		0.39			0.12	0.032	0.043	0.14	Tempered 3 hrs at 550 C after being quenched in oil from 850 C.
52	173	C	1956	323- 473		En 8f	1.05		0.39			0.12	0.032	0.043	0.14	Tempered 3 hrs at 650 C after being quenched in oil from 850 C.
53	173	C	1956	323- 473		En 8g	1.05		0.39			0.12	0.032	0.043	0.14	Annealed 1 hr at 850 C after being quenched in oil from 850 C.
54	173	C	1956	323- 873		En 8h	1.05		0.39			0.12	0.032	0.043	0.14	Reheated at 650 C for 120 hrs after being quenched in oil from 850 C.
55	165	E	1919	303.2		2	0.31	0.004	0.206				0.05	0.04	0.061	
56	165	E	1919	303.2		3	0.6	0.010	0.205				0.05	0.04	0.062	
57	165	E	1919	303.2		4	0.8	0.013	0.205				0.05	0.04	0.063	

SPECIFICATION TABLE NO. 334 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Mn	Al	C	Cr	Cu	Ni	P	S	Si	Composition (continued), Specifications and Remarks
									Composition (weight percent)							
58	165	E	1919	303		5	1.1	0.019	0.205				0.049	0.040	0.064	
59	165	E	1919	303		6	1.6	0.029	0.204				0.049	0.039	0.066	
60	165	E	1919	303		7	2.0	0.037	0.203				0.049	0.039	0.068	
61	174	F	1954	298-1055	5.0	AISI 1010	0.42		0.08				0.015	0.030	0.10	Basic C-1010 fully aluminum-killed steel; annealed at 600 C.
62	166	C	1939	273-623		2	0.31	0.002	0.08	0.045	Trace	0.07	0.029	0.050	0.08	0.032 As; 0.020 Mo; annealed at 930 C.
63	166	C	1939	273-573		3	0.635	0.010	0.23	Trace	0.13	0.074	0.034	0.034	0.11	0.036 As; annealed at 930 C.
64	166	C	1939	273-623		5	0.643	0.006	0.415	Trace	0.12	0.063	0.031	0.029	0.11	0.033 As; annealed at 860 C.
65	166	C	1939	273-623		6	0.69	0.006	0.435	0.03	0.066	0.04	0.037	0.038	0.20	0.024 As; 0.01 Mo; annealed at 860 C.
66	160	F	1938	373-773		1	0.40		0.065						Trace	Nominal composition.
67	160	F	1938	373-773		10	0.84		0.29							Nominal composition.
68	160	F	1938	373-773		11	0.63		0.52							Nominal composition.
69	175	P	1936	303-1073		1	0.16		0.04		0.150		0.007	0.016	0.031	Annealed at 850 C for 2.5 hrs.
70	175	P	1936	303-1073		Carbon steel	0.45		0.28		0.228		0.016	0.056	0.014	Annealed at 850 C for 2.5 hrs.
71	175	P	1936	303-1073		Carbon steel	0.37		0.12		0.148		0.018	0.016	0.009	Annealed at 850 C for 2.5 hrs.
72	561	C	1925	442.2			0.58		0.39			0.20			0.13	
73	561	C	1925	431.4			12		1.2							Quenched in oil from 1200 C.
74	561	C	1925	449.7		CS, Japanese	0.48		0.33						0.12	
75	539	L	1938	323-1122		Carbon steel	0.45		0.18	0.07			0.019	0.007	0.24	0.13 Mo; annealed.
76	31	L	1933	369-715	2.0	Wrought iron	0.20		Trace				0.007	0.014	0.092	Commercially pure.
77	671	L	1961	100-280		2	0.37									Original material remelted and rolled into bars with a cross-section of about 15 mm² and a length of 100 mm; after a short rolling annealed at 1373 K for 2 hrs in evacuated silica tubes, rolled to final form and annealed at about 773 K for 10 hrs; electrical resistivity 3.1, 7.5 and 12.2 μohm cm at 90, 193, and 290 K respectively; original material supplied by Heraeus, A.G. Inc., Hanau, Germany.

SPECIFICATION TABLE NO. 334 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Mn	Al	C	Cr	Cu	Ni	P	S	Si	Composition (continued), Specifications and Remarks
78	671	L	1961	100-280		4	0.521									Similar to the above specimen, except electrical resistivity 5.1, 9.5, and 14.4 μohm cm at 90, 193, and 290 K respectively.
79	937	L	1961	123-813		AISI C 1015	0.55		0.15						0.15	99.1 Fe; specimen 2.54 cm in dia and 37 cm long; normalized at 1227.6 K, tempered at 866.5 K; specimen, chemical composition, heat-treatment history provided by the International Nickel Co.; date presented as a smooth curve.
80	976	L	1933	373-673		Mild steel	0.20		Trace				0.007	0.014	0.09	
81	976	L	1933	373-673		British CS	0.34		0.10				0.031	0.041	0.001	
82	973	L	1966	307-422	<6	H9A	0.50		0.40				0.030	0.025	0.46	Specimen 1.27 cm in dia and 15 cm long; annealed and normalized at 870 C; cast condition; electrical resistivity 24.1, 25.0, 26.3, 28.2, 29.3, 31.0, and 34.3 μohm cm at 20, 41, 59, 94, 113, 146, and 188 C respectively.
83	973	L	1966	337-462	<6	H9A										Similar to the above specimen except in wrought condition and electrical resistivity 23.4, 25.3, 27.3, 29.1, 29.3, 33.2, and 33.2 μohm cm at 23, 63, 92, 119, 134, 177, and 182 C respectively.
84	580	C	1959	373.2		British En8	1.05		0.39			0.12	0.032	0.043	0.14	Wetted in oil.
85	580	C	1959	373.2		Steel	1.05		0.39			0.12	0.032	0.043	0.14	Tempered at 150 C.
86	580	C	1959	373.2		Steel	1.05		0.39			0.12	0.032	0.043	0.14	Tempered at 350 C.
87	580	C	1959	373.2		Steel	1.05		0.39			0.12	0.032	0.043	0.14	Tempered at 550 C.
88	580	C	1959	373.2		Steel	1.05		0.39			0.12	0.032	0.043	0.14	Tempered at 650 C.
89	580	C	1959	373.2		Steel	1.05		0.39			0.12	0.032	0.043	0.14	Annealed at 850 C.
90	17	L	1958	293-353	1.9	42.11 b	0.5		0.37	0.1					0.5	Annealed at 900 C.

SPECIFICATION TABLE NO. 334 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mn	Al	C	Cr	Cu	Ni	P	S	Si	Composition (continued), Specifications and Remarks
91	976	L	1933	373-673		British steel	0.61		0.26				0.025	0.053	0.14	
92	976	L	1933	373-673		British steel	0.67		0.44				0.024	0.037	0.11	

DATA TABLE NO. 334 THERMAL CONDUCTIVITY OF [IRON + MANGANESE + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and P, S, Si $\leq 0.60\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

T	k
CURVE 1	
373.20	0.403
473.20	0.389
573.20	0.376
673.20	0.363
773.20	0.349
CURVE 2	
373.20	0.185
473.20	0.187
573.20	0.190
673.20	0.200
CURVE 3	
14.94	0.0350
17.82	0.0417
21.33	0.0541
76.00	0.181
92.60	0.226
CURVE 4	
15.56	0.0128
18.09	0.0148
21.06	0.0174
75.80	0.0660
88.20	0.0725
CURVE 5	
15.31	0.0211
16.11	0.0225
17.48	0.0255
18.29	0.0271
19.91	0.0322
77.80	0.136
86.10	0.146
CURVE 6	
15.35	0.0276
18.40	0.0333
21.39	0.0425
76.60	0.107
93.10	0.119
CURVE 7	
273.20	0.132
323.20	0.140
373.20	0.149
423.20	0.157
473.20	0.165
523.20	0.174
573.20	0.180
623.20	0.186
673.20	0.195
723.20	0.201
773.20	0.205
823.20	0.209
873.20	0.211
923.20	0.213
973.20	0.216
1023.20	0.218
1073.20	0.222
1123.20	0.224
CURVE 8	
273.20	0.268
323.20	0.272
373.20	0.276
423.20	0.278
473.20	0.282
523.20	0.287
573.20	0.289
623.20	0.289
673.20	0.291
723.20	0.293
773.20	0.293
823.20	0.276
873.20	0.257
923.20	0.232
973.20	0.220
1023.20	0.218
1073.20	0.222
1123.20	0.224
CURVE 9	
303.20	0.260
CURVE 10	
303.20	0.184
CURVE 11	
303.20	0.155
CURVE 12	
303.20	0.147
CURVE 13*	
303.20	0.148
CURVE 14	
273.20	0.460
323.20	0.460
373.20	0.460
423.20	0.456
CURVE 15*	
273.20	0.132
323.20	0.140
373.20	0.149
423.20	0.157
473.20	0.165
523.20	0.174
573.20	0.180
623.20	0.188
CURVE 16	
26.54	0.282
40.03	0.404
55.29	0.506
70.12	0.565
88.53	0.611
101.69	0.620
114.94	0.632
130.23	0.641
144.88	0.648
160.01	0.653
175.14	0.650
203.60	0.652
CURVE 16 (cont.)	
204.43	0.650
211.51	0.652
220.71	0.648
238.33	0.648
256.07	0.647
284.38	0.648
290.29	0.641
298.54	0.634
CURVE 17	
2.70	0.00844
5.30	0.0151
6.38	0.0196
6.83	0.0227
7.64	0.0222
8.60	0.0280
9.21	0.0320
10.24	0.0342
10.56	0.0351
12.04	0.0471
13.93	0.0578
14.29	0.0600
20.30	0.105
21.80	0.111
CURVE 18*	
293.20	0.457
323.20	0.463
353.20	0.468
CURVE 19	
122.50	0.749
154.00	0.669
186.30	0.707
218.50	0.669
345.50	0.644
361.70	0.628
371.80	0.619
378.70	0.586
395.60	0.628
399.50	0.603
400.60	0.582
427.50	0.594
CURVE 19 (cont.)	
431.50	0.544
439.40	0.573
463.60	0.536
465.30	0.569
479.60	0.552
482.20	0.523
511.60	0.548
527.80	0.506
533.90	0.519
535.90	0.506
552.70	0.523
588.10	0.506
596.60	0.477
602.20	0.490
609.40	0.473
625.40	0.485
664.50	0.456
690.90	0.448
703.80	0.435
719.70	0.431
779.30	0.377
792.50	0.402
818.90	0.381
873.90	0.368
942.20	0.335
967.80	0.322
1062.30	0.293
1198.00	0.268
CURVE 20	
293.20	0.531
CURVE 21	
293.20	0.506
CURVE 22	
373.20	0.500
473.20	0.459
573.20	0.424
673.20	0.384
773.20	0.337
873.20	0.296
CURVE 23	
370.20	0.678
391.20	0.669
431.70	0.661
436.70	0.669
448.20	0.657
462.70	0.657
471.70	0.661
484.20	0.653
511.20	0.649
531.70	0.649
532.20	0.644
558.70	0.653
590.70	0.644
627.20	0.644
672.70	0.640
709.70	0.632
CURVE 24	
366.20	0.561
390.70	0.556
427.70	0.556
433.70	0.556
434.70	0.552
451.20	0.548
472.20	0.548
[illegible]	0.548
496.70	0.544
523.20	0.544
533.20	0.552
549.70	0.544
580.20	0.536
624.70	0.540
657.70	0.531
705.20	0.531
CURVE 25*	
365.20	0.544
389.20	0.540
428.20	0.531
435.70	0.536
439.70	0.536
454.20	0.527
471.70	0.531
477.60	0.523
CURVE 25 (cont.)	
500.70	0.519
522.20	0.515
534.70	0.527
555.70	0.527
585.20	0.519
626.20	0.515
665.20	0.506
705.70	0.502
CURVE 26*	
273.20	0.611
373.20	0.551
473.20	0.515
573.20	0.469
673.20	0.418
773.20	0.373
CURVE 27*	
273.20	0.540
373.20	0.502
473.20	0.473
536.40	0.464
CURVE 28	
313.20	0.787
313.20	0.785
CURVE 29	
313.20	0.783
CURVE 30	
313.20	0.764
CURVE 31	
303.20	0.423
CURVE 32*	
303.20	0.414
CURVE 33*	
303.20	0.423
CURVE 34	
303.20	0.452
CURVE 35*	
303.20	0.448
CURVE 36*	
303.20	0.448
CURVE 37*	
303.20	0.356
CURVE 38*	
303.20	0.393
CURVE 39*	
303.20	0.310
CURVE 40*	
303.20	0.339
CURVE 41*	
303.20	0.372
CURVE 42	
303.20	0.322
CURVE 43	
307.20	0.605
CURVE 44	
307.20	0.445

*Not shown on plot

DATA TABLE NO. 334 (continued)

CURVE 45*

T	k
303.20	0.452
396.20	0.452
487.20	0.452
598.20	0.423
777.20	0.372
819.20	0.364
912.20	0.356
973.20	0.364
998.20	0.314
1041.20	0.301
1100.20	0.310
1139.20	0.314

CURVE 46

T	k
303.20	0.339
362.20	0.339
429.20	0.335
503.20	0.339
597.20	0.335
665.20	0.331
727.20	0.318
757.20	0.305
813.20	0.301
916.20	0.293
1000.20	0.243
1046.20	0.251
1135.20	0.259

CURVE 47*

T	k
323.20	0.450
423.20	0.445
523.20	0.435
623.20	0.420
723.20	0.395
823.20	0.370
923.20	0.335
1023.20	0.295
1123.20	0.275

CURVE 48

T	k
323.20	0.395
373.20	0.410

CURVE 49

T	k
323.20	0.405
373.20	0.415

CURVE 50*

T	k
323.20	0.430
373.20	0.435
473.20	0.440

CURVE 51*

T	k
323.20	0.485
373.20	0.485
473.20	0.465

CURVE 52*

T	k
323.20	0.500
373.20	0.500
473.20	0.485

CURVE 53*

T	k
323.20	0.480
373.20	0.485
473.20	0.480

CURVE 54*

T	k
323.20	0.500
373.20	0.500
473.20	0.490
573.20	0.470
673.20	0.445
773.20	0.410
873.20	0.370

CURVE 55*

T	k
303.20	0.464

CURVE 56*

T	k
303.20	0.421

CURVE 57*

T	k
303.20	0.399

CURVE 58*

T	k
303.20	0.412

CURVE 59*

T	k
303.20	0.356

CURVE 60*

T	k
303.20	0.316

CURVE 61*

T	k
298.20	0.569
442.20	0.565
586.20	0.523
683.20	0.498
804.20	0.439
935.20	0.365
1055.20	0.260

CURVE 62*

T	k
273.20	0.594
323.20	0.586
373.20	0.577
423.20	0.552
473.20	0.531
523.20	0.515
573.20	0.494
623.20	0.477

CURVE 63

T	k
273.20	0.519
323.20	0.517
373.20	0.510
423.20	0.498
473.20	0.485
523.20	0.464
573.20	0.444

CURVE 64*

T	k
273.20	0.521
323.20	0.517
373.20	0.506
423.20	0.498
473.20	0.483
523.20	0.469
573.20	0.456
623.20	0.444

CURVE 65*

T	k
273.20	0.481
323.20	0.481
373.20	0.481
423.20	0.477
473.20	0.464
523.20	0.451
573.20	0.439
623.20	0.431

CURVE 66

T	k
373.20	0.808
473.20	0.690
573.20	0.586
673.20	0.515
773.20	0.456

CURVE 67*

T	k
373.20	0.753
473.20	0.644
573.20	0.523
673.20	0.439
773.20	0.379

CURVE 68

T	k
373.20	0.678
473.20	0.552
573.20	0.456
673.20	0.356
773.20	0.314

CURVE 69

T	k
303.20	0.749
323.20	0.694
359.20	0.622
373.20	0.600
418.20	0.518
473.20	0.452
515.20	0.420
573.20	0.386
601.20	0.363
673.20	0.286
740.20	0.225
773.20	0.223
823.20	0.214
873.20	0.203
948.20	0.191
973.20	0.188
1073.20	0.174

CURVE 70*

T	k
303.20	0.689
323.20	0.652
367.20	0.575
373.20	0.565
428.20	0.483
473.20	0.431
504.20	0.400
573.20	0.363
607.20	0.336
673.20	0.268
730.20	0.225
773.20	0.219
833.20	0.211
873.20	0.208
938.20	0.203
973.20	0.200
1073.20	0.193

CURVE 71*

T	k
303.20	0.732
323.20	0.695
364.20	0.624
373.20	0.605

CURVE 71 (cont.)

T	k
424.20	0.524
473.20	0.464
506.20	0.437
573.20	0.391
632.20	0.339
673.20	0.282
754.20	0.225
773.20	0.221
851.20	0.210
873.20	0.206
958.20	0.199
972.20	0.197
1073.20	0.193

CURVE 72*

T	k
442.2	0.492

CURVE 73

T	k
431.4	0.178

CURVE 74*

T	k
449.7	0.596

CURVE 75*

T	k
322.7	0.536
355.2	0.531
374.2	0.536
463.7	0.531
518.2	0.527
579.2	0.506
637.7	0.469
684.7	0.448
731.2	0.427
781.2	0.397
827.2	0.364
865.2	0.356
903.2	0.351
963.7	0.331
1019.7	0.364
1095.7	0.335
1121.7	0.335

CURVE 76*

T	k
368.70	0.736
395.70	0.732
426.70	0.724
432.20	0.728
450.20	0.720
464.70	0.720
475.20	0.724
487.70	0.715
514.70	0.715
523.70	0.724
536.70	0.711
558.70	0.715
590.20	0.711
629.70	0.707
676.70	0.707
715.20	0.699

CURVE 77

T	k
100	0.71
200	0.74
280	0.71

CURVE 78

T	k
100	0.55
200	0.63
280	0.64

CURVE 79

T	k
123.2	0.467
173.2	0.493
273.2	0.520*
373.2	0.519*
473.2	0.499
573.2	0.466*
673.2	0.430
773.2	0.396
813.2	0.386*

CURVE 80

T	k
373.2	0.732
473.2	0.720

CURVE 80 (cont.)

T	k
573.2	0.711
673.2	0.703

CURVE 81*

T	k
373.2	0.674
473.2	0.661
573.2	0.649
673.2	0.640

CURVE 82*

T	k
307.2	0.433
314.2	0.438
315.2	0.426
324.2	0.428
335.2	0.426
368.2	0.429
389.2	0.427
392.2	0.420
422.2	0.422

CURVE 83

T	k
337.2	0.451
345.2	0.428
356.2	0.437
367.2	0.430
372.2	0.442
379.2	0.438
388.2	0.444
395.2	0.439
402.2	0.434
441.2	0.432
455.2	0.425
462.2	0.421

CURVE 84*

T	k
373.2	0.41

CURVE 85*

T	k
373.2	0.415

*Not shown on plot

DATA TABLE NO. 334 (continued)

T	k
CURVE 85*	
373.2	0.435
CURVE 87*	
373.2	0.485
CURVE 88*	
373.2	0.50
CURVE 89*	
373.2	0.485
CURVE 90*	
293.20	0.430
323.20	0.437
353.20	0.445
CURVE 91*	
373.2	0.561
473.2	0.552
573.2	0.544
673.2	0.536
CURVE 92*	
373.2	0.540
473.2	0.527
573.2	0.519
673.2	0.506

* Not shown on plot

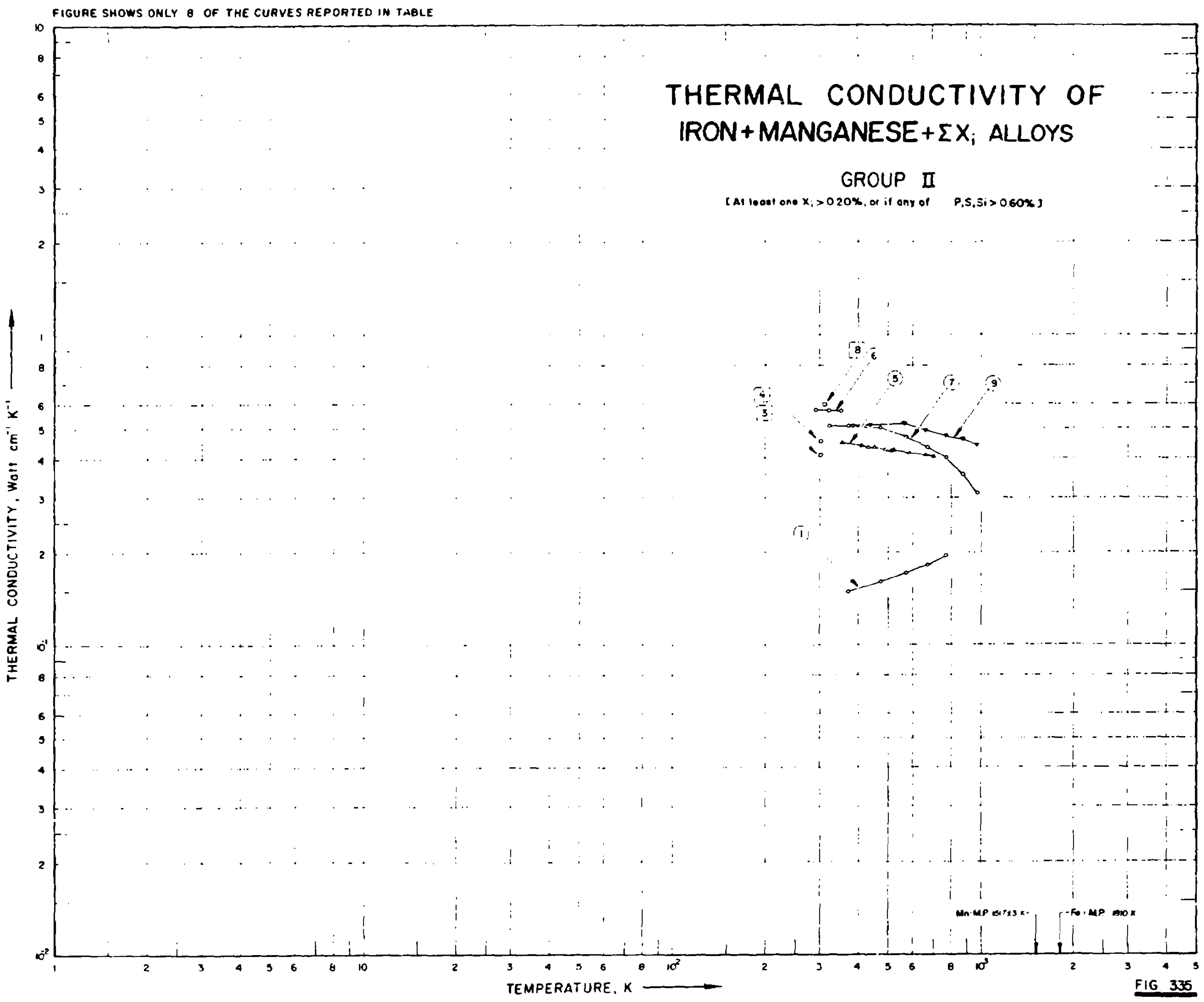


FIGURE SHOWS ONLY 8 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
IRON+MANGANESE+ΣX; ALLOYS
GROUP II
[At least one X; > 0.20%, or if any of P,S,Si > 0.60%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Mn: M.P. 1517±3 K
Fe: M.P. 1810 K

FIG 335

SPECIFICATION TABLE NO. 335 THERMAL CONDUCTIVITY OF [IRON + MANGANESE + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of P, S, Si $> 0.60\%$)

[For Data Reported in Figure and Table No. 335]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Mn	C	Cr	Cu	Mo	Ni	P	S	Si	Composition (continued), Specifications and Remarks
1	129	C	1933	373-773	3.0-5.0	Mn-Ni steel	12.0/ 13.0	0.70/ 0.80				3.0				Commercially pure.
2	178	E	1918	303		1a	0.31	0.09		0.288			0.03	0.026	0.11	Annealed at 900 C.
3	178	E	1918	303		1b	0.31	0.09		0.288			0.03	0.026	0.11	Cooled once to -190 C.
4	208	E	1919	303		1	0.31	0.09		0.288			0.03	0.026	0.11	
5	179	L	1939	355-706	2.0	Mn-Ni cast iron	3.11	3.10				1.00			2.51	Cast in mold.
6	17	L	1958	293-353	1.0	42.11 a	0.40	0.33	0.08	0.25	<0.03				<0.3	<0.05 Ti, <0.03 Mg.
7	209	C	1956	323-973	2.0	B.S. 970 En32A; BGK 1	0.42	0.10	0.07			0.23	0.018	0.036	0.21	
8	204	L	1937	312		Russian alloy 22	32.50	4.55					0.87		0.037	
9	664	E	1957	387-975		Russian steel 12 MKh	0.7	0.16	0.6	0.25	0.6	0.3	0.04	0.04	0.3	Specimen 4 mm in dia and 120 mm long; tempered at 930-940 C (cooling medium is water) and aged at 680-690 C for 2 hrs.

DATA TABLE NO. 335 THERMAL CONDUCTIVITY OF [IRON + MANGANESE + ΣX_i] ALLOYS GROUP II

(At least one X_i >0.20% or if any of P, S, Si >0.60%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k
CURVE 1		CURVE 7 (cont.)	
373.20	0.148	673.20	0.435
473.20	0.160	773.20	0.400
573.20	0.171	873.20	0.355
673.20	0.183	973.20	0.310
773.20	0.195		
CURVE 2*		CURVE 8	
303.2	0.410	311.9	0.597
CURVE 3		CURVE 9	
303.2	0.410	386.7	0.510
CURVE 4		438.7	0.512
303.2	0.456	565.2	0.516
CURVE 5		664.2	0.492
355.70	0.448	771.2	0.472
413.70	0.439	876.2	0.460
431.70	0.435	974.5	0.441
455.20	0.435		
490.20	0.427		
513.70	0.423		
522.70	0.427		
589.70	0.414		
662.70	0.410		
706.20	0.402		
CURVE 6			
293.20	0.575		
323.2	0.573		
353.2	0.571		
CURVE 7			
323.20	0.510		
373.20	0.510		
473.20	0.500		
573.20	0.470		

* Not shown on plot

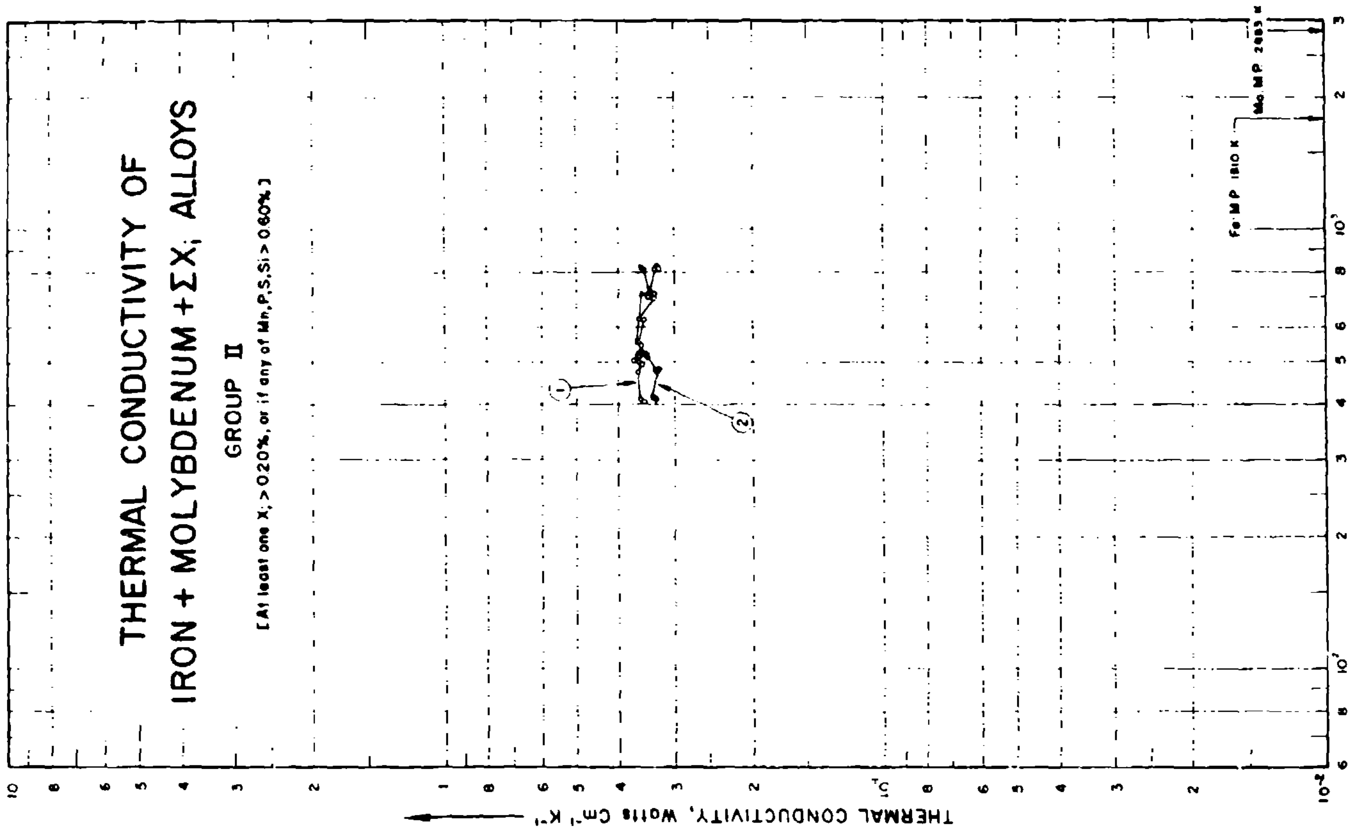

THERMAL CONDUCTIVITY OF
IRON + MOLYBDENUM + ΣX_i ALLOYS
GROUP II
[At least one X_i > 0.20%, or if any of Mn,P,S,Si > 0.60%]
Fe MP 1810 K
Mo MP 2893 K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
June 1962

FIG 336

SPECIFICATION TABLE NO. 336 THERMAL CONDUCTIVITY OF [IRON + MOLYBDENUM + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si $> 0.60\%$)

[For Data Reported in Figure and Table No. 336]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Mo	Al	C	Cr	Mn	Si	V	W	Composition (continued), Specifications and Remarks
1	340	L	1956	408-822	7.0	High speed steel; M-1	8.5			4.0			1.0	1.5	Annealed.
2	340	L	1956	413-820	7.0	High speed steel; M-10	8.0			4.0			2.0		Annealed.

DATA TABLE NO. 336 THERMAL CONDUCTIVITY OF [IRON + MOLYBDENUM + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si $> 0.60\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
407.6	0.353
411.9	0.359
474.1	0.365
494.3	0.356
499.1	0.362
503.1	0.373
516.3	0.362
522.4	0.365
547.4	0.359
554.7	0.361
625.6	0.352
628.3	0.362
700.2	0.335
701.9	0.345
712.8	0.345
716.5	0.335
716.5	0.342
816.0	0.334
817.6	0.327
821.5	0.330
CURVE 2	
413.1	0.332
417.0	0.333
417.4	0.337
478.9	0.330
484.4	0.328
484.4	0.334
517.3	0.346
522.4	0.347
522.4	0.353
557.6	0.366
557.6	0.364
717.8	0.356
720.1	0.349
818.2	0.352
820.4	0.358

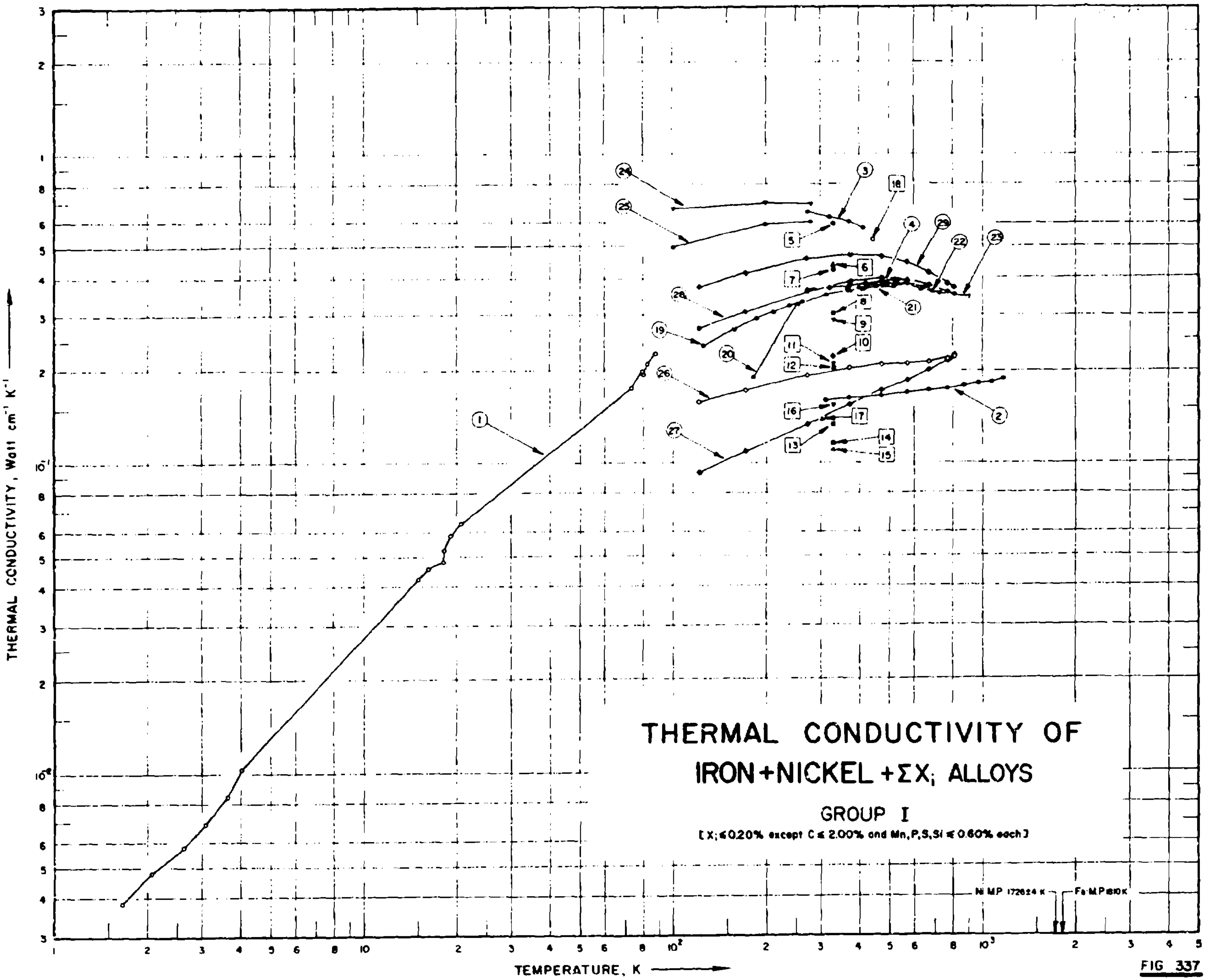

THERMAL CONDUCTIVITY OF
IRON+NICKEL+ΣX; ALLOYS
GROUP I
[X; ≤0.20% except C ≤ 2.00% and Mn,P,S,Si ≤ 0.60% each]
Ni M.P. 1726±4 K
Fe M.P. 1810 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 337

SPECIFICATION TABLE NO. 337 THERMAL CONDUCTIVITY OF [IRON + NICKEL + ΣX_i] ALLOYS GROUP I

($X_i \le 0.20\%$ except C $\le 2.00\%$ and Mn, P, S, Si $\le 0.60\%$ each)

[For Data Reported in Figure and Table No. 337]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Fe	Ni	C	Cr	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
1	157	L	1959	1.6-88		3703	Bal	5.10	0.11		0.34		0.041	0.04	0.16	Annealed.
2	131	C	1953	323-1173	2.0	42% Ni-Iron	55.8	43.91	0.050		0.22			0.003		Annealed at 950 C.
3	166	C	1939	273-423		1	Bal.	0.55	0.06	0.022	0.38	0.030	0.017	0.035	0.01	0.001 Al, 0.039 As, 0.08 Cu; annealed at 930 C.
4	166	C	1939	273-573		9	Bal.	3.47	0.325	0.17	0.55	0.04	0.032	0.034	0.18	0.006 Al, 0.023 As, 0.086 Cu, 0.01 V; annealed at 860 C.
5	206	L	1920	330			Bal.	0	<0.1							Electrolytic.
6	206	L	1920	330			Bal.	1.07	<0.1							Electrolytic.
7	206	L	1920	330			Bal.	1.93	<0.1							Electrolytic.
8	206	L	1920	330			Bal.	7.05	<0.1							Electrolytic.
9	206	L	1920	330			Bal.	10.20	<0.1							Electrolytic.
10	206	L	1920	330			Bal.	13.1	<0.1							Electrolytic.
11	206	L	1920	330			Bal.	19.2	<0.1							Electrolytic.
12	206	L	1920	330			Bal.	22.1	<0.1							Electrolytic.
13	206	L	1920	330			Bal.	25.2	<0.1							Electrolytic.
14	206	L	1920	330			Bal.	28.4	<0.1							Electrolytic.
15	206	L	1920	330			Bal.	35.1	<0.1							Electrolytic.
16	206	L	1920	330			Bal.	47.1	<0.1							Electrolytic.
17	186	P	1928	305		Climax	Bal.	30.0								
18	561	C	1925	446		Japanese steel	Bal.	3.41	0.45							
19	937	L	1961	125-263		AISI 2515	Bal.	4.91	0.14		0.52				0.33	Specimen about 2.54 cm in dia and about 37 cm long; normalized at 1144.3 K, tempered at 866.5 K; furnished by International Nickel Co., chemical composition and heat treatment history provided by the International Nickel Co.
20	937	L	1961	183-483		AISI 2515										The above specimen, run 2.
21	937	L	1961	372-573		AISI 2515										The above specimen, run 3.
22	937	L	1961	400-696		AISI 2515										The above specimen, run 4.

SPECIFICATION TABLE NO. 337 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Fe	Ni	C	Cr	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
23	937	L	1961	423-908		AISI 2515										The above specimen, run 5.
24	671	L	1961	100-280		3		0.946								Original material re-melted and rolled into bars with a cross-section of about 15 mm^2 and a length of 100 mm; after a short rolling annealed at 1373 K for 2 hrs in evacuated silica tubes; rolled to final form and annealed at about 773 K for 10 hrs; electrical resistivity 3.4, 7.9, and 12.9 μohm cm at 90, 193, and 290 K, respectively; original material supplied by Heraeus, A. G. Inc., Hanau, Germany.
25	671	L	1961	100-280		5		1.90								Similar to the above specimen; electrical resistivity 5.3, 9.5, and 15.1 μohm cm at 90, 193, and 290 K respectively.
26	937	L	1961	123-813		High-perm-49	49.503	49.15	0.035	0.09	0.44				0.54	Specimen 2.54 cm in dia and 37 cm long; packed in powder and annealed in hydrogen 5 hrs at 922.1 K, 5 hrs at 1450 K, furnace cooled to 700 K; cooled in hydrogen; specimen furnished by, and chemical composition, heat-treatment history provided by the International Nickel Co.; data presented as a smooth curve.
27	937	L	1961	123-813		Invar	63.97	35.41	0.06	0.04					0.13	Specimen 2.54 cm in dia and 37 cm long; annealed 30 min at 1102.6 K, water quenched, 1 hr at 588.7 K, air cooled, 48 hrs at 369.3 K, air cooled; specimen supplied by, and chemical composition, heat-treatment history provided by International Nickel Co.; data presented as a smooth curve.

SPECIFICATION TABLE NO. 337 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Fe	Ni	C	Cr	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
28	937	L	1961	123-813		AISI 2315	95.483	3.46	0.16		0.54				0.32	Specimen 2.54 cm in dia and 37 cm long; normalized at 1172.5 K and tempered at 866.5 K; specimen furnished by, and chemical composition, heat-treatment history provided by International Nickel Co.; data presented as a smooth curve.
29	937	L	1961	123-813		1% Ni	97.984	1.04	0.120		0.56				0.27	Specimen 2.54 cm in dia and 37 cm long; normalized at 1200 K, tempered at 866.5 K; specimen furnished by, and chemical composition, heat-treatment history provided by International Nickel Co.; data presented as a smooth curve.

DATA TABLE NO. 337 THERMAL CONDUCTIVITY OF (IRON + NICKEL + ΣX_i) ALLOYS GROUP I

(X_i ≤0.20% except C ≤2.00% and Mn, P, S, Si ≤0.60% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
1.66	0.00381
2.06	0.00481
2.62	0.00580
3.07	0.00689
3.63	0.00843
4.04	0.01026
15.04	0.0422
16.16	0.0459
18.14	0.0481
16.15	0.0525
19.21	0.0586
20.60	0.0638
73.76	0.175
79.80	0.199
80.05	0.195
82.92	0.211
87.64	0.227
CURVE 2	
323.20	0.159
373.20	0.161
473.20	0.165
573.20	0.169
673.20	0.171
773.20	0.174
873.20	0.178
973.20	0.181
1073.20	0.184
1173.20	0.188
CURVE 3	
273.20	0.653
323.20	0.628
373.20	0.603
423.20	0.577
CURVE 4	
273.20	0.364
323.20	0.372
373.20	0.377
CURVE 4 (cont.)	
423.20	0.381
473.20	0.389
523.20	0.393
573.20	0.393
CURVE 5	
330.00	0.598
CURVE 6	
330.00	0.435
CURVE 7	
330.00	0.423
CURVE 8	
330.00	0.304
CURVE 9	
330.00	0.288
CURVE 10	
330.00	0.223
CURVE 11	
330.00	0.210
CURVE 12	
330.00	0.205
CURVE 13	
330.00	0.134
CURVE 14	
330.00	0.116
CURVE 15	
330.00	0.110
CURVE 16	
330.00	0.154
CURVE 17	
305.00	0.136
CURVE 18	
445.8	0.527
CURVE 19	
125.2	0.242
158.2	0.270
186.2	0.293
212.2	0.304
239.2	0.321
263.2	0.324
CURVE 20	
193.2	0.290
253.2	0.325
313.2	0.351
373.2	0.363
428.2	0.377
483.2	0.382
CURVE 21	
372.2	0.366
413.2	0.370
453.2	0.377
49[illegible].2	0.382
5[illegible].2	0.381
5[illegible].2	0.384
CURVE 22	
400.2	0.371
CURVE 22 (cont.)	
458.2	0.376*
518.2	0.378
576.2	0.382*
636.2	0.369
696.2	0.362
CURVE 23	
423.2	0.379*
499.2	0.376*
575.2	0.378*
652.2	0.370
730.2	0.359
908.2	0.346
CURVE 24	
100	0.67
200	0.70
280	0.695
CURVE 25	
100	0.497
200	0.59
280	0.60
CURVE 26	
123.2	0.158
173.2	0.173
273.2	0.194
373.2	0.205
473.2	0.210
573.2	0.211
673.2	0.213
773.2	0.218
813.2	0.222
CURVE 27	
123.2	0.093
173.2	0.109
273.2	0.134
CURVE 27 (cont.)	
373.2	0.154
473.2	0.171
573.2	0.186
673.2	0.201
773.2	0.216
813.2	0.223
CURVE 28	
123.2	0.271
173.2	0.307
273.2	0.360
373.2	0.388
473.2	0.397
573.2	0.392*
673.2	0.378
773.2	0.359
813.2	0.351
CURVE 29	
123.2	0.375
173.2	0.408
273.2	0.452
373.2	0.468
473.2	0.461
573.2	0.441
673.2	0.412
773.2	0.392
813.2	0.371

* Not shown on plot

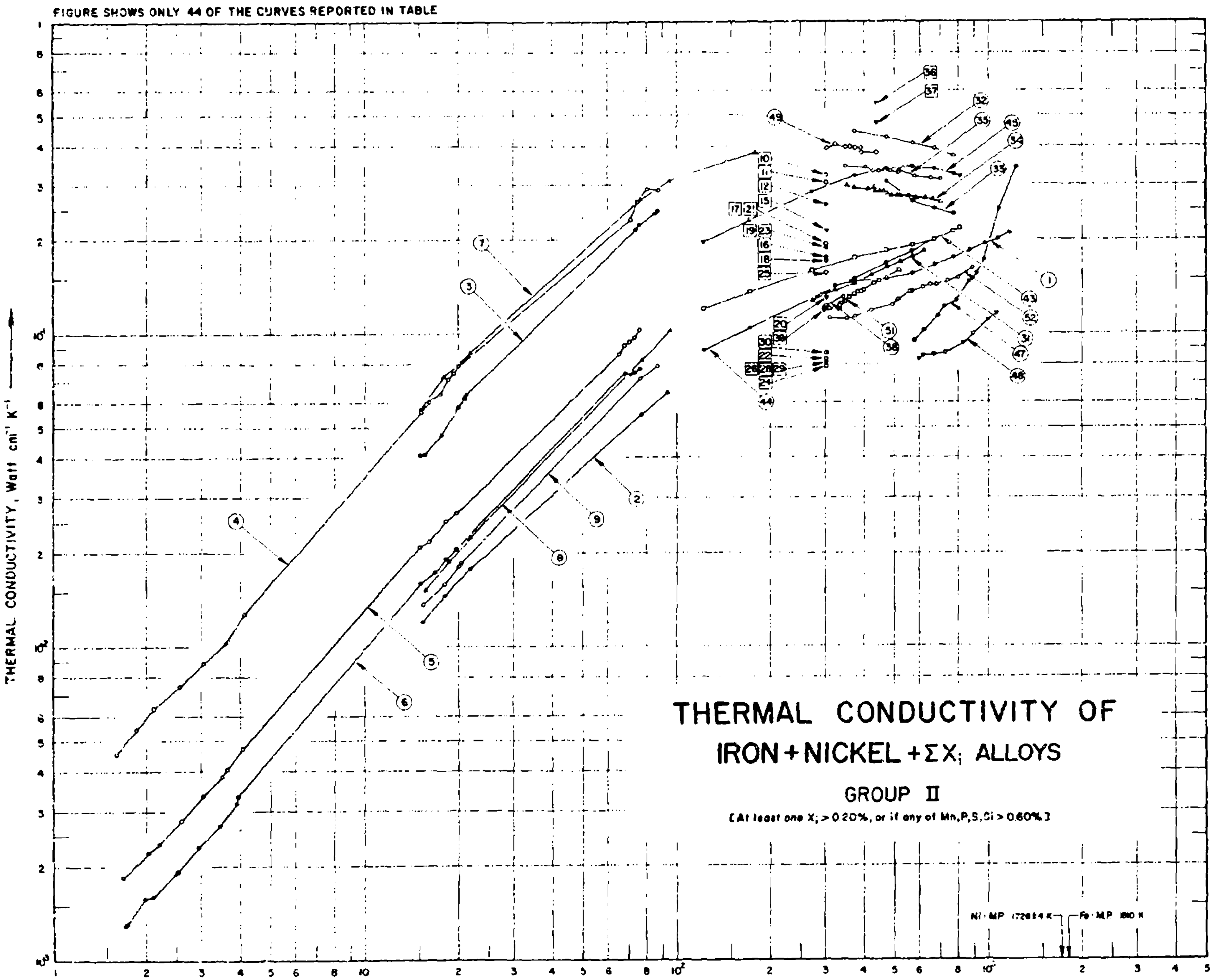


FIGURE SHOWS ONLY 44 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
IRON + NICKEL + ΣX; ALLOYS
GROUP II
[At least one X; > 0.20%, or if any of Mn, P, S, Si > 0.60%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Ni · M.P.
Fe · M.P. 1810 K

FIG 338

SPECIFICATION TABLE NO. 338 THERMAL CONDUCTIVITY OF [IRON + NICKEL + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si > 0.60%)

[For Data Reported in Figure and Table No. 338]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	C	Co	Cr	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
1	131	C	1953	323-1173	2.0	Kovar	28.75	0.017	17.15			0.47				53.7 Fe; annealed at 900 C.
2	104	L	1951	15- 94		1414B	24.30	1.18				6.05				Heated to 1050 C and quenched in water.
3	104	L	1951	15- 87		3975	2.61	0.27		0.49		0.45	0.029	0.011	0.11	0.75 Mo; heated to 850 C and quenched in oil, then reheated to 650 C and quenched in water.
4	157	L	1959	1.6- 88		1287 D	1.92	0.14				0.72			0.21	Annealed.
5	157	L	1959	1.7- 76		1287 I	11.39	0.18				0.93			0.22	Annealed.
6	157	L	1959	1.7- 76		1798 H	19.64	0.43				1.09				Annealed.
7	104	L	1951	15- 100		1287 D	1.92	0.14				0.72			0.21	Heated to 800 C and cooled in furnace.
8	104	L	1951	15- 96		1449 A	31.4	0.70				0.82				Heated to 800 C and cooled in furnace.
9	104	L	1951	15- 87		3450-3	36.17	0.16				0.92		0.09		Heated to 1050 C and quenched in water.
10	178	E	1918	303		2a	4.6	0.10	0.012		0.48	0.31	0.028	0.026	0.11	Approximate composition; annealed at 900 C.
11	178	E	1918	303		2b	4.6	0.10	0.012		0.48	0.31	0.028	0.026	0.11	Approximate composition; cooled once to -190 C in liquid air.
12	178	E	1918	303		3a	9.2	0.11	0.024		0.67	0.32	0.027	0.025	0.11	Approximate composition; annealed at 900 C.
13	178	E	1918	303		3b	9.2	0.11	0.024		0.67	0.32	0.027	0.025	0.11	Approximate composition; cooled once to -190 C in liquid air.
14	178	E	1918	303		4a	13.8	0.12	0.035		0.87	0.32	0.025	0.025	0.12	Approximate composition; annealed at 900 C.
15	178	E	1918	303		4b	13.8	0.12	0.035		0.87	0.32	0.025	0.025	0.12	Approximate composition; cooled once to -190 C in liquid air.
16	178	E	1918	303		5a	18.5	0.13	0.048		1.06	0.32	0.024	0.024	0.12	Approximate composition; annealed at 900 C.
17	178	E	1918	303		5b	18.5	0.13	0.048		1.05	0.32	0.024	0.024	0.12	Approximate composition; cooled once to -190 C in liquid air.
18	178	E	1918	303		6a	21.2	0.135	0.05		1.17	0.32	0.023	0.024	0.12	Approximate composition; annealed at 900 C.
19	178	E	1918	303		6b	21.2	0.135	0.05		1.17	0.32	0.023	0.024	0.12	Approximate composition; cooled once to -190 C in liquid air.
20	178	E	1918	303		7a	23.6	0.14	0.061		1.27	0.32	0.022	0.024	0.12	Approximate composition; annealed at 900 C.
21	178	E	1918	303		7b	23.6	0.14	0.061		1.27	0.32	0.022	0.024	0.12	Approximate composition; cooled once to -190 C in liquid air.
22	178	E	1918	303		9a	27.7	0.15	0.071		1.44	0.32	0.021	0.023	0.12	Approximate composition; annealed at 900 C.
23	178	E	1918	303		9b	27.7	0.15	0.071		1.44	0.32	0.021	0.023	0.12	Approximate composition; cooled once to -190 C in liquid air.
24	178	E	1918	303		10a	29.1	0.15	0.075		1.51	0.32	0.021	0.023	0.12	Approximate composition; annealed at 900 C.

SPECIFICATION TABLE NO. 338 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	C	Co	Cr	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
25	178	E	1918	303		10b	29.1	0.15	0.075		1.51	0.32	0.021	0.023	0.12	Approximate composition; cooled once to -190 C in liquid air.
26	178	E	1918	303		11a	30.5	0.155	0.078		1.56	0.32	0.020	0.023	0.12	Approximate composition; annealed at 900 C.
27	178	E	1918	303		11b	30.5	0.155	0.078		1.56	0.32	0.020	0.023	0.12	Approximate composition; cooled once to -190 C in liquid air.
28	178	E	1918	303		12a	32.8	0.16	0.084		1.65	0.33	0.019	0.023	0.12	Approximate composition; annealed at 900 C.
29	178	E	1918	303		12b	32.8	0.16	0.084		1.65	0.33	0.019	0.023	0.12	Approximate composition; cooled once to -190 C in liquid air.
30	178	E	1918	303		13a	36.9	0.17	0.095		1.83	0.32	0.018	0.022	0.13	Approximate composition; annealed at 900 C.
31	166	C	1939	273- 623		14	28.37	0.28		Trace	0.030	0.89	0.009	0.003	0.15	0.027 As; 0.012 Al; heated to 950 C and cooled in water.
32	129	C	1933	373- 773	3.0-5.0	S2	1.37	0.35		0.46		0.56	0.015	0.02	0.02	Normalized at 900 C.
33	160	F	1938	473- 773		16	1.5	0.30		0.5		0.6			0.35	Annealed.
34	31	L	1933	352- 704	2.0	Nicrosilal	18.65	1.81		2.02					6.42	
35	179	L	1939	347- 702	2.0	Ni-Resist Cast Iron	13.70	2.41		3.37	6.41	0.62			1.80	Cast in mold.
36	561	C	1925	439.4		Crucible steel	2.58	0.22		0.22	0.140	0.60	0.14	0.009	0.23	0.34 W.
37	561	C	1925	439.2		Crucible steel	2.36	0.37		0.82	0.152	1.04	0.016	0.13	0.37	
38	493	L	1922	299-344	1.5		30.40	0.26				0.84			0.14	Forged and worked.
39	493	L	1922	299.2	1.5		30.4	0.26				0.84			0.14	The above specimen annealed for 3 hrs at 690-700 C.
40	493	L	1922	299.2	1.5		30.4	0.26				0.84			0.14	The above specimen cooled from 31 to 29 C in one hr and then cooled to 26 C in one hr.
41	493	L	1922	299.2	1.5		30.4	0.26				0.84			0.14	The above specimen heated to 78 C and and cooled to 76 C in 2 hrs and to 70 C in 2 hrs and then cooled very slowly below 70 C in 3 hrs.
42	493	L	1922	299.2	1.5		30.4	0.26				0.84			0.14	The above specimen heated to 185 C and cooled to 165 C in one hour and cooled below 165 C in 2 hrs.

SPECIFICATION TABLE NO. 338 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	C	Co	Cr	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
43	937	L	1961	123-813		Low-exp-42	42.11	0.085		0.09		0.97			0.16	56.303 Fe; specimen 2.54 cm in dia and 37 cm long; annealed for 30 min at 1088.7 K, furnace cooled; specimen furnished by, and chemical composition, heat-treatment history supplied by International Nickel Co.; data presented as a smooth curve.
44	937	L	1961	123-813		Free cut Invar	35.84	0.08		0.12		0.81			0.34	62.233 Fe; specimen 2.54 cm in dia and 37 cm long; annealed for 30 min at 1102.6 K, water quenched, 1 hr at 588.7 K, air cooled, 48 hrs at 369.3 K, air cooled; specimen furnished by, and chemical composition, heat-treatment history provided by International Nickel Co.; data presented as a smooth curve.
45	937	L	1961	123-813		9% Ni	8.56	0.10				0.77			0.28	90.29 Fe; specimen 2.54 cm in dia and 37 cm long; normalized at (1650 + 1450 F) (1172 + 1061 K), tempered at 838.7 K; specimen furnished by, and chemical composition, heat-treatment history provided by International Nickel Co.; data presented as a smooth curve.
46	976	L	1933	373-673		Cast iron	18.65	1.81		2.02						
47	983, 984	E	1965	578-1230		Alloy No. 3	21.4	0.98			9.9	0.18	Trace	Trace	0.13	Specimen 4 mm in dia and 100 mm long; prepared by powder-metallurgy method (Fe type PZh1M of GOST 9849-61 supplied by Sulinskii Metallurgical Works, Cu type PM-2 of GOST 4960-49 supplied by Pyshmensky Electrolytic Copper Works, Ni type PNE of GOST 9722-61 and C type TKA of GOST 4440-58); sintered at 1413-1433 K for 1.5 hrs in H_2 atmosphere then sintered in cracked ammonia atmosphere; electrical conductivity 0.76, 0.73, 0.68, 0.72, 0.70, 0.60, 0.58, 0.57, 0.55, 0.55, and 0.58 x 10^4 ohm^{-1} cm^{-1} at 305, 348, 414, 450, 517, 588, 644, 694, 805, 817, and 957 C, respectively.

SPECIFICATION TABLE NO. 338 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	C	Co	Cr	Cu	Mn	P	S	Si	Composition (continued), Specifications and Remarks
48	983, 984	E	1965	600-1068		Alloy No. 4	29.8	1.02			9.87	0.15	Trace	Trace	0.14	Similar to the above specimen except electrical conductivity 0.66, 0.64, 0.59, 0.52, 0.47, 0.45, 0.44, and 0.43 x 10^4 ohm^{-1} cm^{-1} at 327, 345, 395, 456, 558, 623, 723 and 795 C, respectively.
49	973	L	1966	304-440	< 6	M8	1.65	0.32		0.69		0.76	0.013	0.015	0.40	0.32 Mo; specimen 1.27 cm in dia and 15 cm long; annealed at 900 C, oil quenched from 870 C and tempered at 600 C; cast condition; electrical resistivity 27.1, 30.7, 33.3, and 36.6 μohm cm, at 19, 72, 110, and 160 C, respectively.
50	973	L	1966	331-453	< 6	M8										Similar to the above specimen except in wrought condition and electrical resistivity 25.9, 27.5, 28.5, 32.3, 34.0, and 36.2 μohm cm at 22, 56, 66, 121, 150, and 179, respectively.
51	973	L	1966	309-519	< 6	Nimonic PE7	37.2	0.1	< 0.2	18.1		0.10			0.22	1.25 Al, 1.18 Ti; specimen 1.27 cm in dia and 15 cm long; fully heat treated; electrical resistivity 107.4, 108.8, 110.9, 114.9, and 116.9 μohm cm at 20, 50, 100, 200, and 250 C, respectively.
52	985	E	1963	311-887			15.4	1.05			9.83	0.19			0.15	Traces of P and S; specimen 4 mm in dia and 100 mm long; sintered for 1.5 hrs at 1140-1150 C in hydrogen atmosphere; electrical resistivity 1.13, 1.23, 1.35, 1.39, 1.49, 1.51, and 1.67 μohm cm at 37.6, 102.2, 219.1, 301.3, 406.3, 527.4, and 613.5 C, respectively.

DATA TABLE NO. 338 THERMAL CONDUCTIVITY OF [IRON + NICKEL + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si $> 0.60\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
323.20	0.142
373.20	0.147
473.20	0.150
573.20	0.156
673.20	0.166
773.20	0.175
873.20	0.184
973.20	0.193
1073.20	0.201
1173.20	0.210
CURVE 2	
15.35	0.0120
18.09	0.0146
21.90	0.0178
77.50	0.0548
93.60	0.0641
CURVE 3	
15.10	0.0408
15.60	0.0410
17.69	0.0474
19.99	0.0581
20.99	0.0619
21.26	0.0637
74.00	0.215
75.90	0.222
85.20	0.242
87.10	0.247
CURVE 4	
1.61	0.00453
1.86	0.00541
2.12	0.00635
2.57	0.00743
3.06	0.00890
3.60	0.0103
4.12	0.0128
15.17	0.0561
16.17	0.0603
CURVE 4 (cont.)	
17.53	0.0638
18.57	0.0715
19.39	0.0745
19.98	0.0779
71.49	0.232
75.34	0.263
80.36	0.289
87.70	0.286
CURVE 5	
1.69	0.00185
2.05	0.00222
2.21	0.00236
2.59	0.00279
3.05	0.00336
3.50	0.00385
3.65	0.00406
4.08	0.00472
15.08	0.0209
16.12	0.0218
18.35	0.0251
19.83	0.0267
65.93	0.0861
68.04	0.0918
70.39	0.0939
73.62	0.0969
76.13	0.1023
CURVE 6	
1.72	0.00130
1.75	0.00132
1.99	0.00158
2.13	0.00160
2.51	0.00191
2.52	0.00193
2.95	0.00229
3.45	0.00268
3.89	0.00317
3.94	0.00334
15.19	0.0159
16.84	0.0172
CURVE 6 (cont.)	
18.31	0.0191
19.69	0.0206
68.32	0.0746
71.12	0.0735
71.18	0.0737
73.52	0.0749
76.34	0.0770
CURVE 7	
15.12	0.0553
17.90	0.0725
21.93	0.0877
76.40	0.267
94.60	0.307
179.80	0.379
CURVE 8	
15.70	0.0152
18.63	0.0188
21.93	0.0225
77.70	0.0826
95.60	0.1028
CURVE 9	
15.45	0.0137
18.11	0.0158
20.08	0.0181
20.41	0.0186
76.80	0.0714
87.00	0.0787
CURVE 10	
303.20	0.320
CURVE 11	
303.20	0.302
CURVE 12	
303.20	0.258
CURVE 13*	
303.20	0.255
CURVE 14*	
303.20	0.218
CURVE 15	
303.20	0.213
CURVE 16	
303.20	0.175
CURVE 17	
303.20	0.192
CURVE 18	
303.20	0.171
CURVE 19	
303.20	0.188
CURVE 20	
303.20	0.130
CURVE 21	
303.20	0.193
CURVE 22	
303.20	0.0833
CURVE 23	
303.20	0.188
CURVE 24	
303.20	0.0782
CURVE 25	
303.20	0.157
CURVE 26	
303.20	0.0808
CURVE 27*	
303.20	0.134
CURVE 28	
303.20	0.0808
CURVE 29	
303.20	0.0808
CURVE 30	
303.20	0.0866
CURVE 31	
273.20	0.128
323.20	0.138
373.20	0.146
423.20	0.155
473.20	0.163
523.20	0.169
573.20	0.176
623.20	0.184
CURVE 32	
373.20	0.445
473.20	0.427
573.20	0.409
673.20	0.391
773.20	0.372
CURVE 33	
473.20	0.305
573.20	0.264
673.20	0.251
773.20	0.243
CURVE 34	
352.70	0.297
371.70	0.293
411.70	0.289
432.20	0.293
433.20	0.285
448.70	0.285
462.20	0.285
474.20	0.280
490.70	0.276
511.20	0.276
525.70	0.276
556.70	0.276
587.70	0.272
629.70	0.272
664.20	0.268
703.70	0.264
CURVE 35	
347.20	0.343
404.20	0.339
426.70	0.331
444.70	0.331
486.20	0.331
514.20	0.326
515.70	0.331
582.20	0.318
657.20	0.314
701.70	0.310
CURVE 36	
439.4	0.545
CURVE 37	
439.2	0.470
CURVE 38	
299.2	0.121
302.4	0.122
344.4	0.131
CURVE 39	
299.2	0.119
CURVE 40*	
299.2	0.120
CURVE 41*	
299.2	0.120
CURVE 42*	
299.2	0.124
CURVE 43	
123.2	0.120
173.2	0.136
273.2	0.159
373.2	0.175
473.2	0.184
573.2	0.191
673.2	0.199
773.2	0.212
813.2	0.218
CURVE 44	
123.2	0.089
173.2	0.104
CURVE 44 (cont.)	
273.2	0.129*
373.2	0.150
473.2	0.167
573.2	0.182
673.2	0.197*
773.2	0.211*
813.2	0.217*
CURVE 45	
123.2	0.196
173.2	0.231
273.2	0.284
373.2	0.319
473.2	0.336
573.2	0.341
673.2	0.336
773.2	0.324
813.2	0.318
CURVE 46*	
373.2	0.293
473.2	0.285
573.2	0.276
673.2	0.268
CURVE 47	
578.2	0.0946
621.2	0.102
687.2	0.114
723.2	0.123
790.2	0.127
861.2	0.147
917.2	0.156
967.2	0.172
1078.2	0.251
1090.2	0.252*
1230.2	0.341
CURVE 48	
600.2	0.0833

* Not shown on plot

DATA TABLE NO. 338 (continued)

T	k
CURVE 48 (cont.)	
618.2	0.0854
668.2	0.0862
729.2	0.0870
831.2	0.0929
896.2	0.0992
996.2	0.110
1068.2	0.116
CURVE 49	
304.2	0.393
322.2	0.403
347.2	0.396
360.2	0.398
374.2	0.394
391.2	0.394
392.2	0.381
440.2	0.381
CURVE 50*	
331.2	0.400
336.2	0.405
336.2	0.394
350.2	0.399
396.2	0.390
421.2	0.385
453.2	0.382
CURVE 51	
309.2	0.120
334.2	0.123
336.2	0.125
336.2	0.127*
348.2	0.127
348.2	0.129*
359.2	0.131
363.2	0.132*
372.2	0.134
379.2	0.134*
383.2	0.136
394.2	0.136
399.2	0.137
430.2	0.145
445.2	0.148

T	k
CURVE 51 (cont.)	
470.2	0.153*
485.2	0.153*
519.2	0.159
CURVE 52	
310.8	0.1117
353.0	0.1113
375.4	0.1138
422.8	0.1179
492.3	0.1243
515.1	0.1284
563.7	0.1356
574.5	0.1360
618.7	0.1406
652.3	0.1439
679.5	0.1439
743.5	0.1477
800.6	0.1510
886.7	0.1623

* Not shown on plot

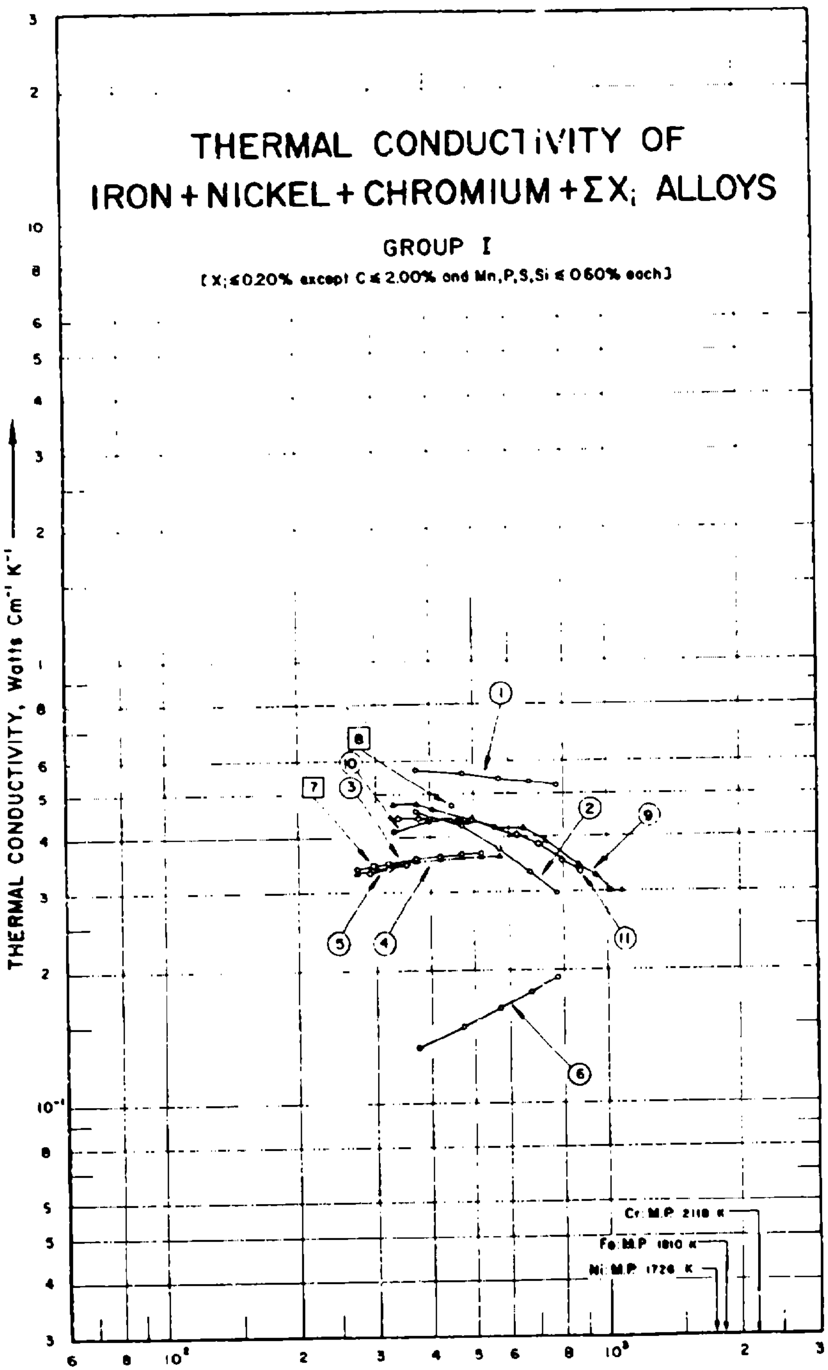

THERMAL CONDUCTIVITY OF
IRON + NICKEL + CHROMIUM + ΣXᵢ ALLOYS
GROUP I
[Xᵢ ≤ 0.20% except C ≤ 2.00% and Mn, P, S, Si ≤ 0.60% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
Cr: M.P. 2118 K
Fe: M.P. 1810 K
Ni: M.P. 1726 K
1
2
3
4
5
6
7
8
9
10
11

FIG 339

SPECIFICATION TABLE NO. 339 THERMAL CONDUCTIVITY OF [IRON + NICKEL + CHROMIUM + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S, Si $\leq 0.60\%$ each)

[For Data Reported in Figure and Table No. 339]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Cr	Al	C	Cu	Mn	Mo	P	Si	Composition (continued), Specifications and Remarks
1	160	F	1938	373-773		15	4.5	1.1		0.13		0.4			0.35	Annealed.
2	160	F	1938	373-773		17	4.5	1.3		0.35		0.6			0.35	Annealed.
3	166	C	1939	273-523		10	3.38	0.80	0.006	0.33	0.053	0.53	0.07	0.031	0.17	0.01 V, 0.028 As, 0.033 S; annealed at 860 C; reheated to 640 C and cooled in furnace.
4	166	C	1939	273-573		11	3.41	0.71	0.008	0.325	0.120	0.55	0.06	0.018	0.25	0.01 V, 0.023 As, 0.025 S; annealed at 860 C; reheated to 640 C and cooled in furnace.
5	17	L	1958	293-353	1.0	AMS 2713	1.7	0.7		0.55		0.6	0.2		0.3	0.1 V; annealed and quenched.
6	129	C	1933	373-773	3.0-5.0	Chromel 502	34.0	10.0								Hot rolled.
7	177	C	1936	298.2	10.0	KHZN	2.89	1.02		0.27		0.32		0.025	0.25	Normalized.
8	561	C	1925	449.6		Japanese steel	3.17	0.45		0.33						
9	539	L	1938	330-1073		Ni - Cr steel	2.92	0.72		0.29		0.42		0.010	0.21	0.012 S; quenched in oil from 850 C, then tampered at 600 C and quenched in water.
10	539	L	1938	334-492			2.92	0.72		0.29		0.42		0.010	0.21	0.012 S; quenched in oil from 850 C.
11	539	L	1938	340-876			2.92	0.72		0.29		0.42		0.010	0.21	0.012 S; quenched in oil from 850 C, and tempered at 300 C

DATA TABLE NO. 339 THERMAL CONDUCTIVITY OF [IRON + NICKEL + CHROMIUM + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S, Si $\leq 0.60\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
373.2	0.573
473.2	0.561
573.2	0.544
673.2	0.536
773.2	0.523
CURVE 2	
373.2	0.456
473.2	0.423
573.2	0.377
673.2	0.335
773.2	0.297
CURVE 3	
273.2	0.343
323.2	0.351
373.2	0.360
423.2	0.364
472.2	0.368
523.2	0.368
CURVE 4	
273.2	0.335
323.2	0.347
373.2	0.356
423.2	0.360
473.2	0.364
523.2	0.364
573.2	0.364
CURVE 5	
293.2	0.336
323.2	0.343
353.2	0.350
CURVE 6	
273.2	0.134
473.2	0.149
CURVE 6 (cont.)	
573.2	0.163
673.2	0.177
773.2	0.192
CURVE 7	
298.2	0.347
CURVE 8	
449.6	0.472
CURVE 9	
330.2	0.478
375.2	0.475
406.2	0.464
562.2	0.419
650.2	0.421
730.2	0.393
865.2	0.349
942.2	0.330
1029.2	0.301
1073.2	0.302
CURVE 10	
334.2	0.414
399.2	0.438
492.2	0.437
CURVE 11	
340.2	0.443
378.2	0.441
499.2	0.439
631.2	0.405
699.2	0.388
802.2	0.359
876.2	0.340

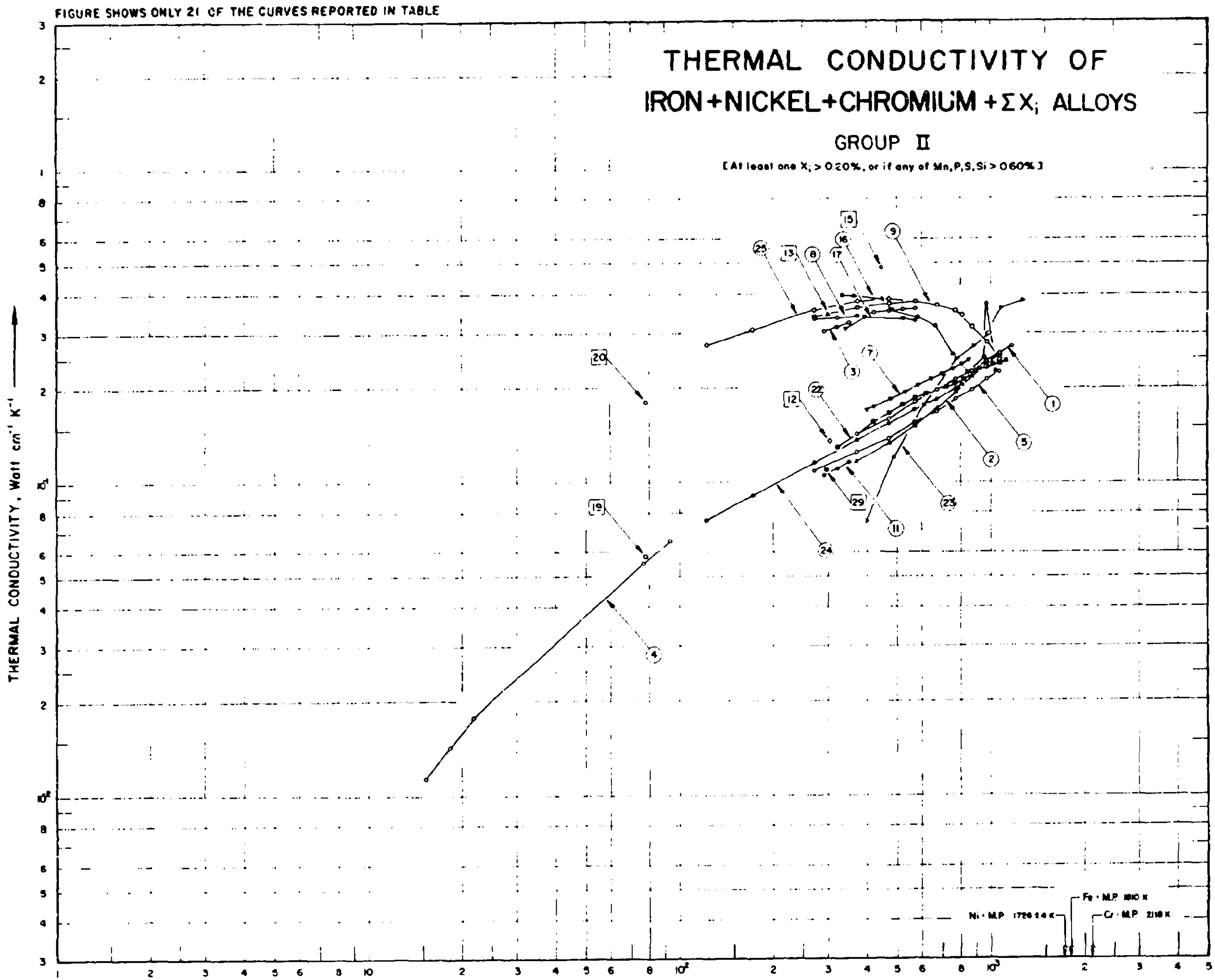


FIGURE SHOWS ONLY 21 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
IRON+NICKEL+CHROMIUM+ΣX$_i$ ALLOYS
GROUP II
[At least one X$_i$ > 0.20%, or if any of Mn, P, S, Si > 0.60%]
Fe · M.P. 1810 K
Ni · M.P. 1728 ± 4 K
Cr · M.P. 2118 K
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K

FIG 340

SPECIFICATION TABLE NO. 340 THERMAL CONDUCTIVITY OF (IRON + NICKEL + CHROMIUM + ΣX_i) ALLOYS GROUP II

(At least one X_i > 0.20% or if any of Mn, P, S, Si > 0.60%)

[For Data Reported in Figure and Table No. 340]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Ni	Cr	C	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
							Composition (weight per cent)								
1	181	L	1953	373-1173		Rex 78	18.0	14.0	0.1	0.5	3.5			0.5	3.5 Cu; 0.75 Ti.
2	181	L	1953	373-1073		Jessop G 17	25.0	13.0	0.4	0.8	2.0			1.5	2.5 W.
3	17	R, L	1958	293- 353	1.0	AMS 2714	1.7	1.0	0.55	0.7	0.5			0.3	0.1 V; annealed and quenched.
4	104	L	1951	15- 93		Era ATV steel: 3731	27.3	14.6	0.44	1.34				1.62	3.5 W; heated to 1000 C and quenched in water.
5	162	C	1936	273-1073		Era ATV steel	26.86	15.20	0.46	1.18		0.018	0.014	1.30	52.2 Fe; 2.77 W; forged.
6	181	L	1953	373-1173		G 18 B	13.0	13.0	0.4	0.8	2.0			1.0	10.0 Co; 3.0 Nb; 2.5 W.
7	37	C	1951	400- 851	4.0	N-155	20.0	20.0	0.2		3.25				20.0 Co; 2.5 W; 1.1 Nb.
8	166	C	1939	273- 573		12	3.53	0.78	0.34	0.55	0.39	0.024	0.003	0.27	0.050 Co; 0.037 As; 0.007 Al; annealed at 860 C, then reheated to 640 C and cooled in furnace.
9	162	C	1936	273-1073		F. N. C. T. steel	3.55	0.85	0.39	0.64				0.21	Oil-hardened from 830 C and tempered at 600 C.
10	185	C, L	1960	273-1073	2.0	Macloy G steel	36.5	16.75	0.49	0.58		0.012	0.016	1.9	Heated to 1050 C and cooled in air.
11	17	R, L	1958	293- 353	1.0	Vacromin F	32.31	20.03		1.42	0.10			Trace	Trace Al.
12	186	P	1928	305		Climax	29.0	2.0		1.0					
13	177	C	1936	298	10.0	5 ZA 2 steel	4.11	1.54	0.32	0.37		0.018		0.30	0.83 W; normalized.
14	187		1955	373, 1173		Nimonic DS	≈37	≈18	0.15 Max	1.5 Max				2.5 Max	
15	561	C	1925	448.2		Crucible steel	2.23	0.88	0.26	0.32			0.013	0.26	0.38 V.
16	539	L	1938	332-1049		Ni - Cr steel	4.33	1.12	0.31	0.38	0.37	0.021	0.006	0.15	0.27 W; quenched in oil from 850 C and then tempered at 600 C.
17	539	C	1938	342- 574		Ni - Cr steel	4.33	1.12	0.31	0.38	0.37	0.021	0.006	0.15	Quenched in oil from 850 C.
18	539	C	1938	335- 736		Ni - Cr steel	4.33	1.12	0.31	0.38	0.37	0.021	0.006	0.15	The above specimen tempered again at 320 C.
19	537		1940	78.2		Ni + Cr + W Steel	26.56	14.13	0.42	1.06				1.50	2.21 W, P and S unknown; commercial heat resistant alloy; forged; measured in a boiling nitrogen bath.
20	537		1940	78.2		Low alloy steel	3.00	0.98	0.28	0.8					Si unknown; commercial heat resistant alloy; oil hardened from 830 C and then tempered at 600 C; measured in a boiling nitrogen bath.
21	504	P	1961	295.2	±5	AISI 4340 steel	1.65/ 2.00	0.70/ 0.90	0.38/ 0.43	0.6/ 0.8	0.2/ 0.3	0.04	0.04	0.2/ 0.35	Nominal composition from Mark's handbook.

SPECIFICATION TABLE NO. 340 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Ni	Cr	C	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
22	666		1963	323-1123	2.0	EI-855	36.55	15.5	0.08	0.46		0.0125	0.047	0.55	2.88 W and 0.31 Ti; quenched in air from 1100 C.
23	664	E	1957	400-1273	±4	Russian steel EI-257	15	15	0.15	0.7	0.4	0.035	0.030	0.8	2.75 W; austenitic; specimen 4 mm in dia and 120 mm long; tempered at 1175 C (cooling medium: water) and aged at 750 C for 10 hrs.
24	937	L	1961	123-813		Ni-Span-C	41.95	5.31	0.03	0.42					49.332 Fe, 2.51 Ti, 0.38 Al; specimen 2.54 cm in dia and 37 cm long, after machining at NBS age hardened for 6 hrs in a vacuum furnace at 955.4 K; furnace cooled; specimen, chemical composition, heat-treatment history provided by the International Nickel Co.; data presented as a smooth curve.
25	937	L	1961	123-813		AISI 4340QT	1.87	0.74	0.40	0.68	0.25			0.28	95.747 Fe; specimen 2.54 cm in dia and 37 cm long; normalized at 1144.3 K, oil-quenched at 1088.7 K, tempered at 866.5 K; specimen, chemical composition, heat-treatment history provided by the International Nickel Co.; data presented as a smooth curve.
26	937	L	1961	123-813		AISI 4340NT	1.87	0.74	0.40	0.68	0.25			0.28	Similar to the above specimen except only normalized at 1144.3 K and tempered at 866.5 K.
27	765	C	1957	298.2		Alloy steel	3.4	0.8	0.3						Thermal comparator applied on the machined curved surface of the 1 in. dia bar specimen.
28	765	C	1957	298.2		High alloy steel	36.5	16.75	0.49					1.90	Thermal comparator applied on the machined curved surface of the 1 in. dia bar specimen.
29	765	C	1957	298.2		High alloy steel	36.5	16.75	0.49					1.90	Thermal comparator loaded with 100 gram weight applied on the plane lapped surface of the specimen.

DATA TABLE NO. 340 THERMAL CONDUCTIVITY OF [IRON + NICKEL + CHROMIUM + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, $Si > 0.60\%$)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
373.20	0.142
473.20	0.159
573.20	0.180
673.20	0.197
773.20	0.213
873.20	0.226
973.20	0.243
1073.20	0.259
1173.20	0.272

CURVE 2

T	k
373.20	0.117
473.20	0.134
573.20	0.151
673.20	0.172
773.20	0.193
873.20	0.218
973.20	0.238
1073.20	0.268

CURVE 3

T	k
293.20	0.303
323.20	0.313
353.20	0.322

CURVE 4

T	k
15.30	0.0114
18.30	0.0143
21.78	0.0179
76.90	0.0551
93.40	0.0651

CURVE 5

T	k
273.20	0.109
373.20	0.126
473.20	0.138
573.20	0.155
673.20	0.168
773.20	0.184

CURVE 5 (cont.)

T	k
873.20	0.197
973.20	0.213
1073.20	0.226

CURVE 6*

T	k
373.20	0.134
473.20	0.153
573.20	0.174
673.20	0.188
773.20	0.205
873.20	0.222
973.20	0.238
1073.20	0.257
1173.20	0.276

CURVE 7

T	k
400.40	0.170
422.00	0.174
477.60	0.184
533.20	0.194
588.70	0.204
644.30	0.214
699.80	0.222
755.40	0.231
810.90	0.238
851.00	0.245

CURVE 8

T	k
273.20	0.331
323.20	0.335
373.20	0.339
423.20	0.347
473.20	0.351
523.20	0.356
573.20	0.358

CURVE 9

T	k
273.20	0.335
373.20	0.360

CURVE [illegible] (cont.)

T	k
473.20	0.372
573.20	0.377
673.20	0.368
773.20	0.352
873.20	0.314
973.20	0.280
1073.20	0.247

CURVE 10*

T	k
273.20	0.103
373.20	0.122
473.20	0.141
573.20	0.160
673.20	0.178
773.20	0.194
873.20	0.207
973.20	0.221
1073.20	0.235

CURVE 11

T	k
293.20	0.106
323.20	0.111
353.20	0.117

CURVE 12

T	k
305.00	0.136

CURVE 13

T	k
298.20	0.343

CURVE 14*

T	k
373.20	0.142
1173.20	0.314

CURVE 15

T	k
448.2	0.491

CURVE 16

T	k
332.2	0.397
363.2	0.396
449.2	0.387
482.2	0.354
584.2	0.338
663.2	0.317
752.2	0.256
851.2	0.225
955.2	0.250
973.2	0.372
1049.2	0.226

CURVE 17

T	k
342.2	0.310
395.2	0.336
529.2	0.333
574.2	0.327

CURVE 18*

T	k
335.2	0.380
386.2	0.396
569.2	0.354
689.2	0.295
736.2	0.269

CURVE 19

T	k
78.2	0.0582

CURVE 20

T	k
78.2	0.180

CURVE 21*

T	k
295.2	0.335

CURVE 22

T	k
323.2	0.130
373.2	0.143*

CURVE 22 (cont.)*

T	k
423.2	0.156
473.2	0.166
523.2	0.176
573.2	0.184
623.2	0.191
673.2	0.197*
723.2	0.201
773.2	0.206
823.2	0.213
873.2	0.222*
923.2	0.229
973.2	0.233
1023.2	0.238
1073.2	0.241
1123.2	0.244

CURVE 23

T	k
400.2	0.0753
489.2	0.121
616.2	0.176
703.2	0.222*
776.2	0.247
878.2	0.272
974.2	0.295
1083.2	0.360
1272.5	0.383

CURVE 24

T	k
123.2	0.076
173.2	0.091
273.2	0.116
373.2	0.137
473.2	0.154
573.2	0.170
673.2	0.184
773.2	0.198
813.2	0.204

CURVE 25

T	k
123.2	0.275

CURVE 25 (cont.)

T	k
173.2	0.307
273.2	0.354
373.2	0.379
473.2	0.386
573.2	0.380*
673.2	0.366*
773.2	0.348*
813.2	0.341

CURVE 26*

T	k
123.2	0.262
173.2	0.296
273.2	0.344
373.2	0.369
473.2	0.377
573.2	0.372
673.2	0.359
773.2	0.345
813.2	0.340

CURVE 27*

T	k
298.2	0.343

CURVE 28*

T	k
298.2	0.11

CURVE 29

T	k
298.2	0.109

* Not shown on plot

GROUP I

SPECIFICATION TABLE NO. 341 THERMAL CONDUCTIVITY OF [IRON + PHOSPHOROUS + ΣX_i] ALLOYS

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S, Si $\leq 0.60\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	204	L	1937	387		40	21 P; S, Si.

GROUP I

DATA TABLE NO. 341 THERMAL CONDUCTIVITY OF [IRON + PHOSPHORUS + ΣX_i] ALLOYS

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S, Si $\leq 0.60\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
386.7	0.363

* No graphical presentation

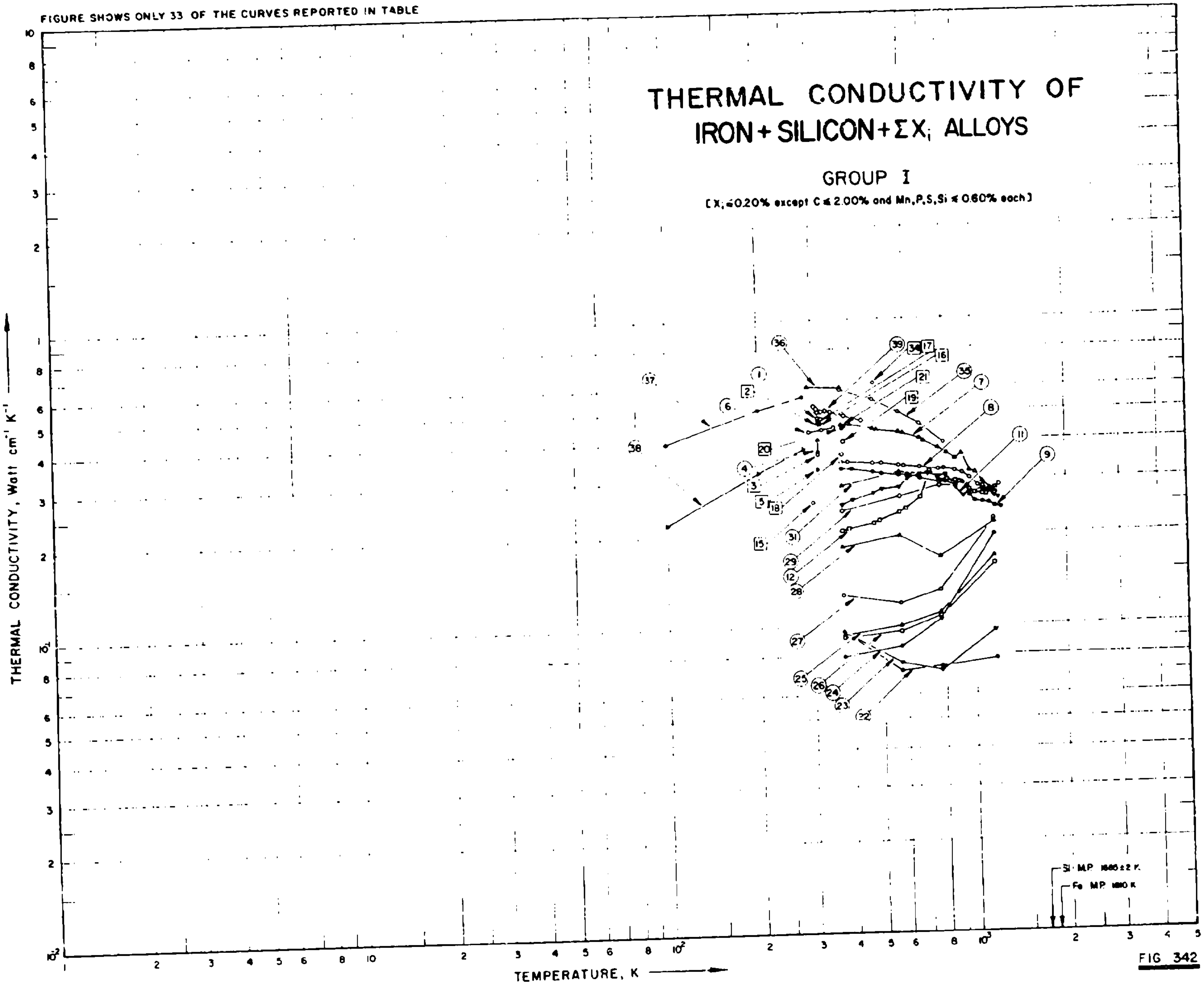


FIGURE SHOWS ONLY 33 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
IRON + SILICON + ΣX_i ALLOYS
GROUP I
[X_i ≤ 0.20% except C ≤ 2.00% and Mn, P, S, Si ≤ 0.60% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Si M.P. 1680 ± 2 K
Fe M.P. 1810 K

FIG 342

SPECIFICATION TABLE NO. 342 THERMAL CONDUCTIVITY OF [IRON + SILICON + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except $C \leq 2.00\%$ and Mn, P, S $\leq 0.60\%$ each)

[For Data Reported in Figure and Table No. 342]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Si	Al	C	Cr	Mn	P	S	Composition (continued) Specifications and Remarks
1	170	L	1926	313.2		2.1	0.65		0.45		0.35	0.015	0.02	Annealed.
2	170	L	1926	313.2		2.2	0.65		0.45		0.35	0.015	0.02	Forged.
3	170	L	1926	313.2		2.3h	0.65		0.45		0.35	0.015	0.02	Annealed and then quenched from 800 C.
4	170	L	1926	313.2		3.2	0.86		0.55		0.44	0.014	0.02	Forged.
5	170	L	1926	313.2		3.3h	0.86		0.55		0.44	0.014	0.02	Annealed and then quenched from 800 C.
6	17	L	1958	293-353	1.0	42.11b	0.5		0.37	0.1	0.5			
7	210	R	1956	373-1173	4.0		1.90		0.07		0.25	0.024	0.026	Unfinished.
8	210	R	1956	373-1173	4.0		1.23	0.01	0.09		0.29	0.047	0.029	0.35 mm foil.
9	210	R	1956	373-1235	4.0		1.80	0.01	0.09		0.32	0.038	0.023	0.35 mm foil.
10	210	R	1956	373-1203	4.0		2.20							The rest not determined, billet specimen.
11	210	R	1956	373-1203	4.0		2.78	0.06	0.09		0.35	0.034	0.023	Billet specimen.
12	210	R	1956	373-1213	4.0		3.94	0.09	0.08		0.27	0.027	0.008	0.35 mm foil.
13	210	R	1956	373-1183	4.0		4.28	0.05	0.06		0.08	0.012	0.006	Billet specimen.
14	210	R	1956	373-1183	4.0		4.38	0.05	0.07		0.20	0.015	0.008	Unfinished.
15	203	L	1957	300	± 1.5	2164	2.4		<0.1		0.39			[5.0 pearlite]; annealed at 900 C for 12 hrs and furnace-cooled.
16	204	L	1937	319.5		Ferrosilicon 45%; 6	47.2							Heat-flow parallel to thickness.
17	204	L	1937	320.7		Ferrosilicon 45%; 7	44.0							Heat-flow parallel to thickness.
18	204	L	1937	374.7		Russian alloy; 8	16.0							
19	204	L	1937	379.5		Russian alloy; 9	10.01							
20	204	L	1937	376.6		Russian alloy; 10	10.30							
21	204	L	1937	382.4		Russian alloy; 11	12.92							
22	356	R	1956	373-1173	± 7.0		45.0							
23	356	R	1956	373-1173	± 7.0		38.0							
24	356	R	1956	373-1173	± 7.0		32.0							
25	356	R	1956	373-1173	± 7.0		29.0							
26	356	R	1956	373-1173	± 7.0		25.0							
27	356	R	1956	373-1173	± 7.0		17.0							
28	356	R	1956	373-1173	± 7.0		10.0							
29	356	R	1956	373-1173	± 7.0		4.4							

SPECIFICATION TABLE NO. 342 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Si	Al	C	Cr	Mn	P	S	Composition (continued), Specifications and Remarks
30	356	R	1956	373-1173	±7.0		2.8							
31	356	R	1956	373-1173	±7.0		2.2							
32	356	R	1956	373-1173	±7.0		1.3							
33	356	R	1956	373-1173	±7.0		0.9							
34	561	L	1925	479.2			0.51		0.13	0.03	0.01	0.005	0.010	0.016 Cu, 0.05 Ni.
35	129	C	1933	373-802	3.0-5.0	Wrought iron	0.265		0.04		0.046	0.136	0.025	Hot rolled.
36	77	C	1900	291, 373		Fe II	0.2		0.1		0.1	Trace	Trace	99.55 Fe, trace Cu.
37	671	L	1961	100-280		G	0.592							Original material re-melted and rolled into bars with a cross-section of about 15 mm^2 and a length of 100 mm, after a short rolling annealed at 1373 K for 2 hrs in evacuated silica tubes, rolled to final form and annealed at about 773 K for 10 hrs; electrical resistivity 8.4, 12.9, and 17.7 μohm cm at 90, 193, and 290 K respectively; original material supplied by Heraeus, A. G. Inc., Hanau, Germany.
38	671	L	1961	100-280		7	1.47							Similar to the above specimen; electrical resistivity 20.1, 24.7, and 29.1 μohm cm at 90, 193 and 290 K respectively.
39	973	L	1966	305-436	<6	E10A	0.4		0.11		0.35	0.011	0.028	Specimen 1.27 cm in dia and 15 cm long; annealed and normalized at 950 C; cast condition; electrical resistivity 19.4, 20.5, 21.7, 24.5, 27.3, and 29.4 μohm cm at 18, 34, 56, 108, 156, and 189 C, respectively.
40	973	L	1966	336-446	<6	E10A								Similar to the above specimen except in wrought condition; electrical resistivity 19.0, 22.1, 25.6, and 28.0 μohm cm at 21, 71, 93, 137, and 172 C, respectively.

DATA TABLE NO. 342 THERMAL CONDUCTIVITY OF [IRON + SILICON + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S $\leq 0.60\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
313.2	0.469
313.2	0.477

CURVE 2

T	k
313.2	0.460

CURVE 3

T	k
313.2	0.364

CURVE 4

T	k
313.2	0.372
313.2	0.406

CURVE 5

T	k
313.2	0.326

CURVE 6

T	k
293.2	0.430
323.2	0.437
353.2	0.445

CURVE 7

T	k
373.2	0.452
398.2	0.452
473.2	0.439
488.2	0.435
573.2	0.427
593.2	0.423
673.2	0.406
693.2	0.397
773.2	0.377
823.2	0.364
873.2	0.347
918.2	0.360
973.2	0.318
1018.2	0.312
1073.2	0.293

CURVE 7 (cont.)

T	k
1143.2	0.277
1173.2	0.272

CURVE 8

T	k
373.2	0.343
393.2	0.343
473.2	0.339
503.2	0.339
573.2	0.333
598.2	0.331
673.2	0.328
773.2	0.322
808.2	0.324
873.2	0.318
933.2	0.312
973.2	0.301
1043.2	0.285
1073.2	0.282
1153.2	0.272
1173.2	0.268

CURVE 9

T	k
373.2	0.326
403.2	0.326
473.2	0.318
503.2	0.314
573.2	0.310
613.2	0.310
673.2	0.301
773.2	0.293
813.2	0.293
873.2	0.285
923.2	0.290
973.2	0.264
1013.2	0.253
1073.2	0.251
1133.2	0.249
1173.2	0.243
1235.2	0.241

CURVE 10

T	k
373.2	0.289
393.2	0.293
473.2	0.303
503.2	0.308
573.2	0.310
591.2	0.333
673.2	0.310
728.2	0.308
773.2	0.303
820.2	0.297
873.2	0.289
898.2	0.310
973.2	0.276
998.2	0.272
1073.2	0.268
1108.2	0.264
1173.2	0.264
1203.2	0.264

CURVE 11

T	k
373.2	0.249
403.2	0.258
473.2	0.272
503.2	0.289
573.2	0.293
613.2	0.301
673.2	0.310
713.2	0.312
773.2	0.305
816.2	0.308
873.2	0.280
930.2	0.262
973.2	0.272
1073.2	0.276
1098.2	0.274
1173.2	0.264
1203.2	0.259

CURVE 12

T	k
373.2	0.207
393.2	0.209

CURVE 12 (cont.)

T	k
473.2	0.21[illegible]
493.2	0.222
573.2	0.234
603.2	0.241
673.2	0.262
723.2	0.318
773.2	0.293
823.2	0.297
873.2	0.295
903.2	0.292
973.2	0.272
1013.2	0.269
1073.2	0.268
1103.2	0.268
1173.2	0.278
1213.2	0.285

CURVE 13*

T	k
373.2	0.215
393.2	0.213
473.2	0.222
503.2	0.226
573.2	0.238
603.2	0.238
673.2	0.253
723.2	0.310
773.2	0.274
803.2	0.272
873.2	0.272
918.2	0.264
973.2	0.264
1003.2	0.256
1023.2	0.257
1073.2	0.264
1103.2	0.278
1173.2	0.289
1183.2	0.292

CURVE 14*

T	k
373.2	0.234
403.2	0.241

CURVE 14 (cont.)*

T	k
473.2	0.249
485.2	0.253
573.2	0.266
613.2	0.261
673.2	0.278
753.2	0.286
773.2	0.285
798.2	0.285
873.2	0.282
898.2	0.279
973.2	0.272
1009.2	0.271
1023.2	0.268
1073.2	0.268
1093.2	0.274
1173.2	0.280
1183.2	0.285

CURVE 15

T	k
300	0.255

CURVE 16

T	k
319.5	0.459

CURVE 17

T	k
320.7	0.474

CURVE 18

T	k
374.7	0.364

CURVE 19

T	k
379.5	0.399

CURVE 20

T	k
376.6	0.442

CURVE 21

T	k
382.4	0.450

CURVE 22

T	k
373.2	0.0962
573.2	0.0711
773.2	0.0732
1173.2	0.0774

CURVE 23

T	k
373.2	0.0962*
573.2	0.0753
773.2	0.0711
1173.2	0.0962

CURVE 24

T	k
373.2	0.0795
573.2	0.0858
773.2	0.105
1173.2	0.197

CURVE 25

T	k
373.2	0.094
573.2	0.100
773.2	0.109
1173.2	0.167

CURVE 26

T	k
373.2	0.0920
573.2	0.0962
773.2	0.107
1173.2	0.159

CURVE 27

T	k
373.2	0.126
573.2	0.117
773.2	0.130
1173.2	0.222

CURVE 28

T	k
373.2	0.182
573.2	0.197
773.2	0.167
1173.2	0.218

CURVE 29

T	k
373.2	0.238
573.2	0.264
773.2	0.285
1173.2	0.276*

CURVE 30*

T	k
373.2	0.249
573.2	0.293
773.2	0.295
1173.2	0.264

CURVE 31

T	k
373.2	0.289
573.2	0.314
773.2	0.305*
1173.2	0.264*

CURVE 32*

T	k
373.2	0.343
573.2	0.335
773.2	0.326
1173.2	0.272

CURVE 33*

T	k
373.2	0.452
573.2	0.414
773.2	0.372
1173.2	0.272

CURVE 34

T	k
479.2	0.260

CURVE 35

T	k
373.2	0.589
473.2	0.543
573.2	0.497
673.2	0.451
773.2	0.405
802.2	0.392

CURVE 36

T	k
291.2	0.601
373.2	0.594

CURVE 37

T	k
100	0.400
200	0.51
280	0.56

CURVE 38

T	k
100	0.22
200	0.32
280	0.38

CURVE 39

T	k
305.2	0.521
311.2	0.514
313.2	0.500
316.2	0.509*
322.2	0.503
333.2	0.504
345.2	0.497
381.2	0.485
436.2	0.467

CURVE 40*

T	k
336.2	0.497
350.2	0.497
358.2	0.495
368.2	0.491
388.2	0.491
401.2	0.478
412.2	0.485
446.2	0.470

* Not shown on plot

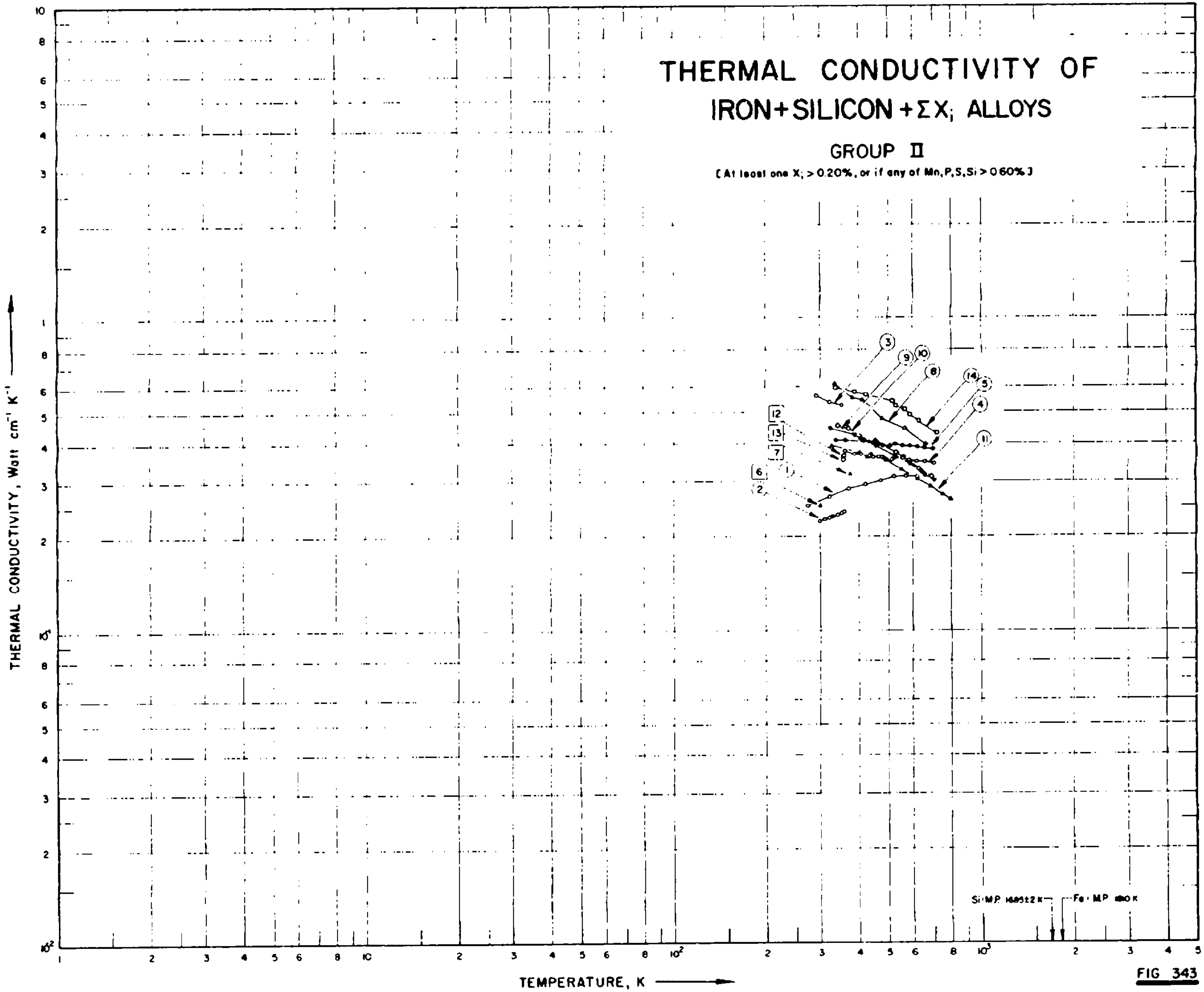

THERMAL CONDUCTIVITY OF
IRON+SILICON+ΣX; ALLOYS
GROUP II
[At least one X; > 0.20%, or if any of Mn, P, S, Si > 0.60%]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Si: M.P.
Fe: M.P.

FIG 343

SPECIFICATION TABLE NO. 343 THERMAL CONDUCTIVITY OF [IRON + SILICON + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S $> 0.60\%$)

[For Data Reported in Figure and Table No. 343]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Si	C	Cr	Cu	Mn	Ni	P	S	Composition (continued), Specifications and Remarks
1	166	C	1939	273-623		21	1.98	0.485	0.04	0.637	0.90	0.156	0.044	0.047	0.007 Al, 0.029 As; annealed at 930 C.
2	17	L	1958	299-360	1.0	Cast iron Nr 1510	3.53	2.16	0.05	0.04	0.3	≤1.0			0.06 Mg, 0.05 V.
3	17	L	1958	293-353	1.0	Cast iron Nr 1520	2.99	2.66	0.05	0.04	0.2	≤0.3			
4	31	L	1933	360-703	2.0	Silal	6.49	2.75							
5	31	L	1933	339-700	2.0	Cast iron: 5	4.20	3.02			0.28		0.30	0.043	
6	203	L	1957	300	± 1.5	2165	2.8	< 0.1			0.37	1.0			[Trace pearlite]; annealed at 900 C for 12 hrs and furnace-cooled.
7	204	L	1937	377		Russian alloy; ~~##~~ 39	35								7.0 Zr.
8	211	E	1953	336-660	± 3.0		0.60	0.06							98.4 Fe, 0.59 O_2 (contained in 0.65 FeO and 1.5 Fe_2O_3); 5.1% porosity; sintered 1 hr and 30 min at 1150 C and annealed 30 min at 825 C.
9	211	E	1953	325-703	± 3.0		0.60	0.18			0.35				98.11 Fe, 0.76 O_2 (contained in 0.70 FeO and 1.8 Fe_2O_3); 11.4% porosity; sintered 1 hr and 30 min at 1150 C and annealed 30 min at 825 C.
10	211	E	1953	343-693	± 3.0		0.70	0.097			0.35				98.183 Fe, 0.67 O_2 (contained in 0.4 FeO and 1.9 Fe_2O_3); 14.3% porosity; sintered 1 hr and 30 min at 1150 C and annealed 30 min at 825 C.
11	211	E	1953	328-795	± 3.0		0.59	0.087			0.35				98.263 Fe, 0.71 O_2 (contained in 0.6 FeO and 1.9 Fe_2O_3); 17% porosity; sintered 1 hr and 30 min at 1150 C and annealed 30 min at 825 C.
12	205	C	1953	358		Nodular Iron	3.53	3.47			0.29	1.3	0.03	0.012	0.06 Mg; cast.
13	205	C	1953	358		Nodular Iron	4.34	3.36			0.4	1.23	0.03	0.01	0.06 Mg; cast.
14	560	E	1953	340-723	±3.0		0.4	0.058			0.30				0.56 O; sintered at 1150 C and kept in this condition for 1 hr 30 min.

SPECIFICATION TABLE NO. 343 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Si	C	Cr	Cu	Mn	Ni	P	S	Composition (continued), Specifications and Remarks
							Composition (weight percent)								
15	975	L	1933	373-673		Cast iron	4.20	3.02			0.28		0.30	0.043	
16	976	L	1933	373-673		Silal iron	6.49	2.75							

DATA TABLE NO. 343 THERMAL CONDUCTIVITY OF [IRON + SILICON + ΣX_i] ALLOYS GROUP II

(At least one X_i >0.20% or if any of Mn, P, S >0.60%)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
273.20	0.251
323.20	0.269
373.20	0.285
423.20	0.293
473.20	0.301
523.20	0.310
573.20	0.312
623.20	0.310
CURVE 2	
299.20	0.224
310.60	0.227
321.70	0.229
326.20	0.231
327.70	0.231
340.90	0.235
351.00	0.238
360.20	0.240
CURVE 3	
293.20	0.561
323.20	0.538
353.20	0.526
CURVE 4	
360.20	0.377
386.70	0.368
407.70	0.368
434.20	0.364
438.70	0.368
446.20	0.360
462.20	0.360
476.70	0.360
483.20	0.356
512.20	0.351
520.20	0.356
557.70	0.356
583.70	0.351
618.20	0.347
656.70	0.347
702.70	0.343
CURVE 5	
339.20	0.410
363.70	0.410
415.70	0.406
417.20	0.410
431.20	0.402
449.70	0.402
453.20	0.402
465.20	0.397
480.20	0.393
507.20	0.393
527.20	0.397
554.20	0.393
587.70	0.393
620.20	0.389
653.70	0.385
699.70	0.381
CURVE 6	
300.00	0.251
CURVE 7	
377.20	0.317
CURVE 8	
335.70	0.615
384.60	0.552
411.10	0.544
478.80	0.477
567.40	0.444
659.70	0.397
CURVE 9	
325.20	0.448
388.70	0.427
403.50	0.414
452.00	0.393
521.30	0.364
587.80	0.343
641.00	0.322
658.60	0.314
703.20	0.301
CURVE 10	
342.60	0.452
371.60	0.444
455.10	0.402
529.00	0.372
557.10	0.360
631.20	0.326
692.50	0.310
CURVE 11	
327.90	0.393
401.70	0.372
429.50	0.360
492.40	0.351
550.90	0.326
623.10	0.305
687.30	0.289
752.30	0.272
795.10	0.264
CURVE 12	
358.00	0.362
CURVE 13	
358.00	0.351
CURVE 14	
339.5	0.598
389.0	0.577
425.8	0.565
516.6	0.540
530.1	0.523
566.7	0.506
590.7	0.490
630.5	0.469
723.2	0.431
CURVE 15*	
373.2	0.406
473.2	0.397
CURVE 15 (cont.)*	
573.2	0.353
673.2	0.385
CURVE 16*	
373.2	0.372
473.2	0.364
573.2	0.351
673.2	0.343

* Not shown on plot

SPECIFICATION TABLE NO. 344 THERMAL CONDUCTIVITY OF [IRON + TITANIUM + ΣX_i] ALLOYS GROUP I

(X_i <0.20% except C ≤2.00% and Mn, P, S, Si ≤0.60% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	204	L	1937	393		Ferrotitanium, 37	19.70 Ti and 0.09 C.

DATA TABLE NO. 344 THERMAL CONDUCTIVITY OF [IRON + TITANIUM + ΣX_i] ALLOYS GROUP I

(X_i ≤0.20% except C ≤2.00% and Mn, P, S, Si ≤0.60% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1*	
393.2	0.628

*No graphical presentation

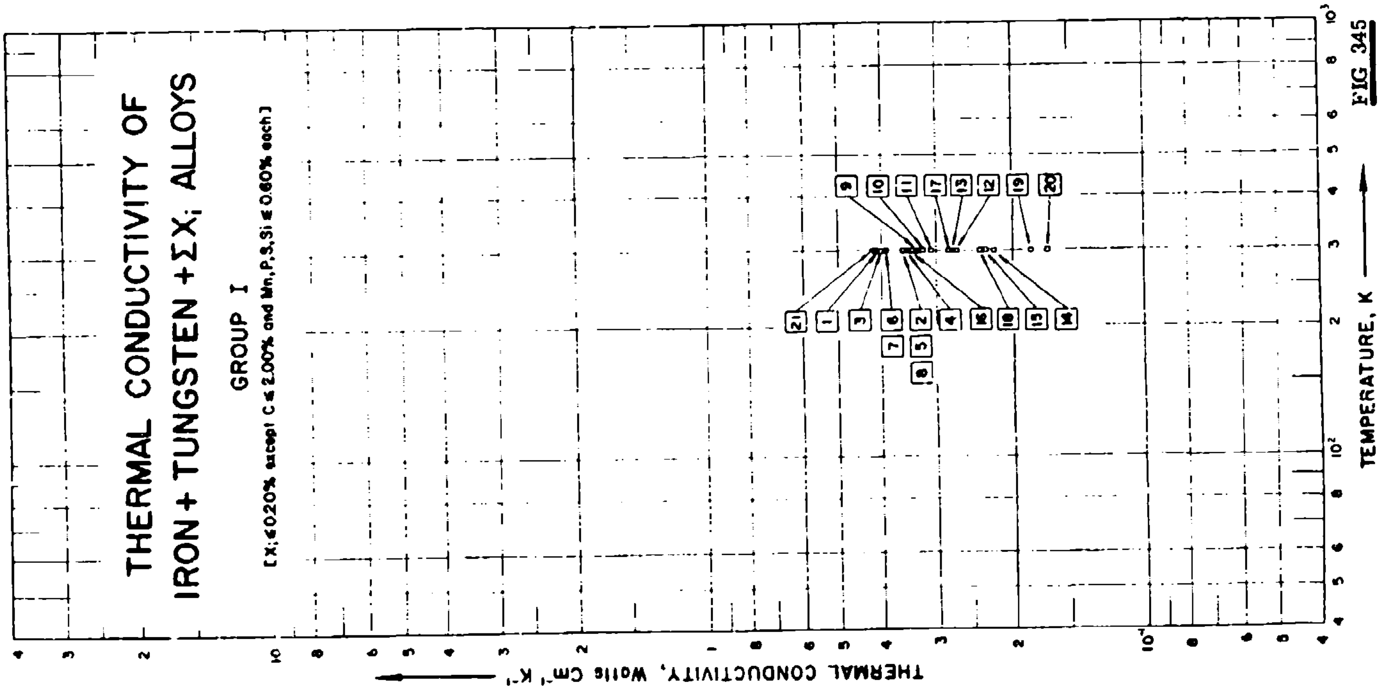

THERMAL CONDUCTIVITY OF
IRON + TUNGSTEN + ΣX_i ALLOYS
GROUP I
[X_i ≤ 0.20% except C ≤ 2.00% and Mn, P, S, Si ≤ 0.60% each]
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 345

SPECIFICATION TABLE NO. 345 THERMAL CONDUCTIVITY OF [IRON + TUNGSTEN + ΣX_i] ALLOYS GROUP I

(X_i < 0.20% except C < 2.00% and Mn, P, S, Si < 0.60% each)

[For Data Reported in Figure and Table No. 345]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight per cent) W	C	Mn	P	S	Si	Composition (continued), Specifications and Remarks
1	188	E	1919	303		3a	1.0	0.3					Annealed at 900 C and slowly cooled.
2	188	E	1919	303		3b	1.0	0.6					Annealed at 900 C and slowly cooled.
3	188	E	1919	303		4a	2.0	0.3					Annealed at 900 C and slowly cooled.
4	188	E	1919	303		4b	2.0	0.6					Annealed at 900 C and slowly cooled.
5	188	E	1919	303		5b	3.0	0.6					Annealed at 900 C and slowly cooled.
6	188	E	1919	303		6a	5.0	0.3					Annealed at 900 C and slowly cooled.
7	188	E	1919	303		7a	6.0	0.3					Annealed at 900 C and slowly cooled.
8	188	E	1919	303		7b	6.0	0.6					Annealed at 900 C and slowly cooled.
9	188	E	1919	303		8b	10.0	0.6					Annealed at 900 C and slowly cooled.
10	188	E	1919	303		9a	15.0	0.3					Annealed at 900 C and slowly cooled.
11	188	E	1919	303		9b	15.0	0.6					Annealed at 900 C and slowly cooled.
12	188	E	1919	303		10a	20.0	0.3					Annealed at 900 C and slowly cooled.
13	188	E	1919	303		10b	20.0	0.6					Annealed at 900 C and slowly cooled.
14	188	E	1919	303		11a	25.0	0.3					Annealed at 900 C and slowly cooled.
15	188	E	1919	303		11b	25.0	0.6					Annealed at 900 C and slowly cooled.
16	188	E	1919	303		12	1.0	0.6					Annealed at 1100 C and quickly cooled.
17	188	E	1919	303		13	3.0	0.6					Annealed at 1100 C and quickly cooled.
18	188	E	1919	303		14	6.0	0.6					Annealed at 1100 C and quickly cooled.
19	188	E	1919	303		15	20.0	0.6					Annealed at 1100 C and quickly cooled.
20	188	E	1919	303		16	25.0	0.6					Annealed at 1100 C and quickly cooled.
21	188	E	1919	303		2a	0.5	0.3					Annealed at 900 C and slowly cooled.

DATA TABLE NO. 345 THERMAL CONDUCTIVITY OF [IRON + TUNGSTEN + ΣX_i] ALLOYS GROUP I

($X_i \leq 0.20\%$ except C $\leq 2.00\%$ and Mn, P, S, Si $\leq 0.60\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		CURVE 13	
303.20	0.411	303.20	0.276
CURVE 2		CURVE 14	
303.20	0.360	303.20	0.221
CURVE 3		CURVE 15	
303.20	0.402	303.20	0.231
CURVE 4		CURVE 16	
303.20	0.349	303.20	0.343
CURVE 5		CURVE 17	
303.20	0.356	303.20	0.280
CURVE 6		CURVE 18	
303.20	0.390	303.20	0.238
CURVE 7		CURVE 19	
303.20	0.387	303.20	0.182
CURVE 8		CURVE 20	
303.20	0.356	303.20	0.167
CURVE 9		CURVE 21	
303.20	0.333	303.20	0.419
CURVE 10			
303.20	0.324		
CURVE 11			
303.20	0.309		
CURVE 12			
303.20	0.270		

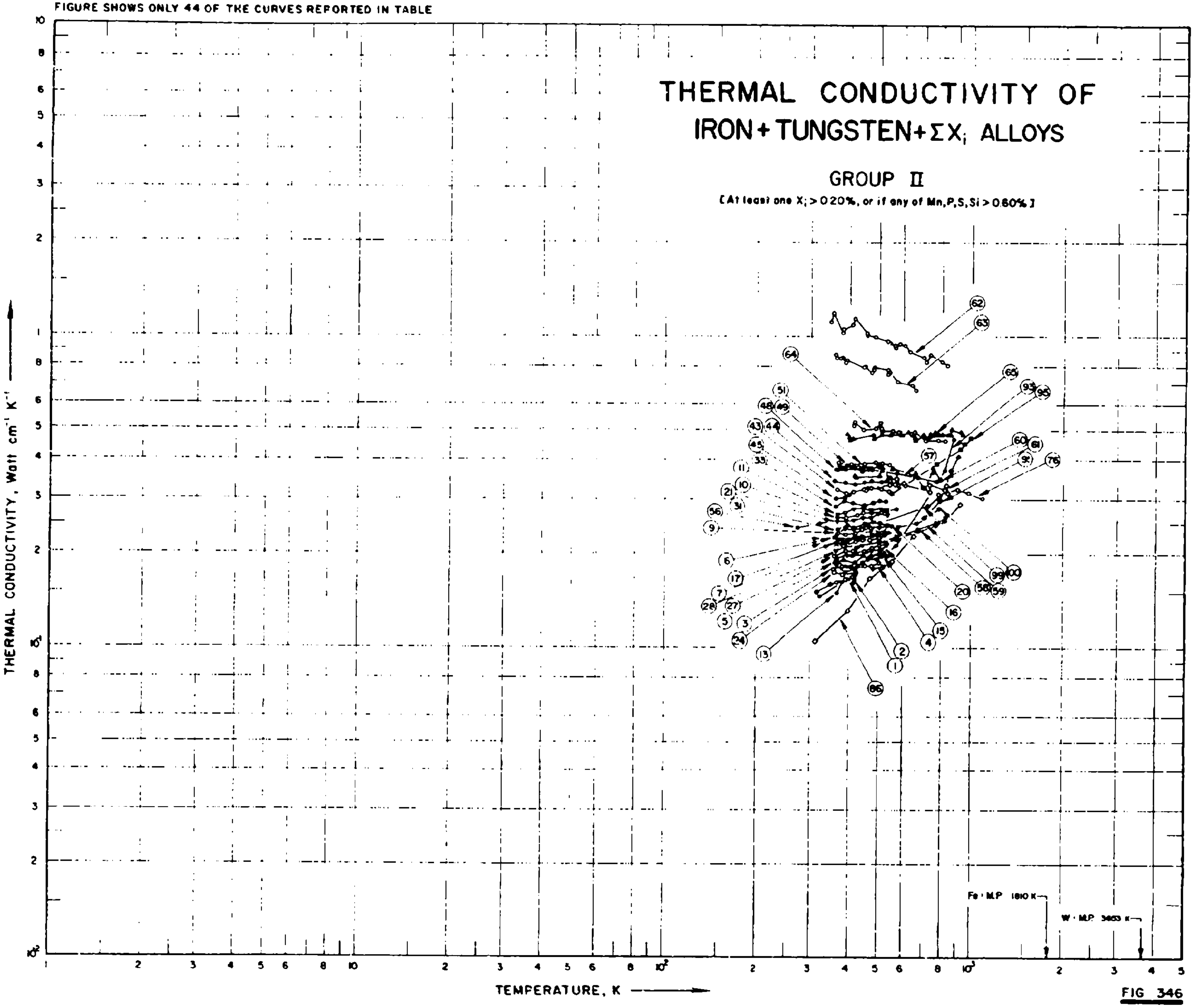


FIGURE SHOWS ONLY 44 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
IRON + TUNGSTEN + ΣX; ALLOYS
GROUP II
[At least one X; > 0.20%, or if any of Mn,P,S,Si > 0.60%]
Fe · M.P. 1810 K
W · M.P. 3653 K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 346

SPECIFICATION TABLE NO. 346 THERMAL CONDUCTIVITY OF [IRON + TUNGSTEN + ΣX_i] ALLOYS GROUP II

(At least one $X_i > 0.20\%$ or if any of Mn, P, S, Si > 0.60%)

[For Data Reported in Figure and Table No. 346]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	W	C	Cr	Cu	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
							Composition (weight per cent)									
1	189	L	1934	366-411	2.0-5.0	High speed steel G_Q	18.65	0.734	4.07	0.066	0.242	0.730	Trace	0.037	0.272	4.90 Co, trace Ti, 1.93 V; oil-quenched from 1300 C.
2	189	L	1934	368-420	2.0-5.0	High speed steel; $G_{T.\ 200\ C}$	18.65	0.734	4.07	0.066	0.242	0.730	Trace	0.037	0.272	4.90 Co, trace Ti, 1.93 V; tempered at 200 C for 30 min and cooled in air.
3	189	L	1934	358-503	2.0-5.0	High speed steel; $G_{T.\ 300\ C}$	18.65	0.734	4.07	0.066	0.242	0.730	Trace	0.037	0.272	4.90 Co, trace Ti, 1.93 V; tempered at 300 C for 30 min and cooled in air.
4	189	L	1934	367-526	2.0-5.0	High speed steel; $G_{T.\ 400\ C}$	18.65	0.734	4.07	0.066	0.242	0.730	Trace	0.037	0.272	4.90 Co, trace Ti, 1.93 V; tempered at 400 C for 30 min and cooled in air.
5	189	L	1934	363-527	2.0-5.0	High speed steel; $G_{T.\ 500\ C}$	18.65	0.734	4.07	0.066	0.242	0.730	Trace	0.037	0.272	4.90 Co, trace Ti, 1.93 V; tempered at 500 C for 30 min and cooled in air.
6	189	L	1934	362-535	2.0-5.0	High speed steel; $G_{T.\ 550\ C}$	18.65	0.734	4.07	0.066	0.242	0.730	Trace	0.037	0.272	4.90 Co, trace Ti, 1.93 V; tempered at 550 C for 30 min and cooled in air.
7	189	L	1934	369-544	2.0-5.0	High speed steel; $G_{T.\ 600\ C}$	18.65	0.734	4.07	0.066	0.242	0.730	Trace	0.037	0.272	4.90 Co, trace Ti, 1.93 V; tempered at 600 C for 30 min and cooled in air.
8	189	L	1934	365-533	2.0-5.0	High speed steel; $G_{T.\ 650\ C}$	18.65	0.734	4.07	0.066	0.242	0.730	Trace	0.037	0.272	4.90 Co, trace Ti, 1.93 V; tempered at 650 C for 30 min and cooled in air.
9	189	L	1934	373-538	2.0-5.0	High speed steel; $G_{T.\ 700\ C}$	18.65	0.734	4.07	0.066	0.242	0.730	Trace	0.037	0.272	4.90 Co, trace Ti, 1.93 V; tempered at 700 C for 30 min and cooled in air.
10	189	L	1934	368-533	2.0-5.0	High speed steel; $G_{T.\ 800\ C}$	18.65	0.734	4.07	0.066	0.242	0.730	Trac	[illegible]	0.272	4.90 Co, trace Ti, 1.93 V; tempered at 800 C for 30 min and cooled in air.
11	189	L	1934	368-537	2.0-5.0	High speed steel; G_A	18.65	0.734	4.07	0.066	0.242	0.730	[illegible]	[illegible]	[illegible] 272	4.90 Co, trace Ti, 1.93 V; annealed at 830 C.
12	189	L	1934	370-419	2.0-5.0	High speed steel; E_Q	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; oil-quenched from 1300 C.
13	189	L	1934	368-416	2.0-5.0	High speed steel; $E_{T.\ 200\ C}$	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; tempered at 200 C for 30 min and cooled in air.
14	189	L	1934	365-499	2.0-5.0	High speed steel; $E_{T.\ 300\ C}$	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; tempered at 300 C for 30 min and cooled in air.
15	189	L	1934	368-540	2.0-5.0	High speed steel; $E_{T.\ 400\ C}$	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; tempered at 400 C for 30 min and cooled in air.
16	189	L	1934	371-535	2.0-5.0	High speed steel; $E_{T.\ 500\ C}$	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; tempered at 500 C for 30 min and cooled in air.

SPECIFICATION TABLE NO. 346 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	W	C	Cr	Cu	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
							Composition (weight per cent)									
17	189	L	1934	366-526	2.0-5.0	High speed steel; $E_{T.\ 550\ C}$	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; tempered at 550 C for 30 min and cooled in air.
18	189	L	1934	359-533	2.0-5.0	High speed steel; $E_{T.\ 600\ C}$	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; tempered at 600 C for 30 min and cooled in air.
19	189	L	1934	368-531	2.0-5.0	High speed steel; $E_{T.\ 650\ C}$	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; tempered at 650 C for 30 min and cooled in air.
20	189	L	1934	365-542	2.0-5.0	High speed steel; $E_{T.\ 700\ C}$	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; tempered at 700 C for 30 min and cooled in air.
21	189	L	1934	369-535	2.0-5.0	High speed steel; $E_{T.\ 800\ C}$	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; tempered at 800 C for 30 min and cooled in air.
22	189	L	1934	370-547	2.0-5.0	High speed steel; E_A	19.22	0.674	3.45	0.072	0.165	0.275	Trace	0.010	0.535	0.736 Co, trace Ti, 0.848 V; annealed at 830 C.
23	189	L	1934	359-425	2.0-5.0	High speed steel; H_Q	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; quenched from 1300 C.
24	189	L	1934	361-425	2.0-5.0	High speed steel; $H_{T.\ 200\ C}$	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; tempered at 200 C for 30 min and cooled in air.
25	189	L	1934	368-499	2.0-5.0	High speed steel; $H_{T.\ 300\ C}$	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; tempered at 300 C for 30 min and cooled in air.
26	189	L	1934	365-526	2.0-5.0	High speed steel; $H_{T.\ 400\ C}$	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; tempered at 400 C for 30 min and cooled in air.
27	189	L	1934	360-535	2.0-5.0	High speed steel; $H_{T.\ 500\ C}$	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; tempered at 500 C for 30 min and cooled in air.
28	189	L	1934	365-535	2.0-5.0	High speed steel; $H_{T.\ 550\ C}$	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; tempered at 550 C for 30 min and cooled in air.
29	189	L	1934	370-537	2.0-5.0	High speed steel; $H_{T.\ 600\ C}$	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; tempered at 600 C for 30 min and cooled in air.
30	189	L	1934	369-534	2.0-5.0	High speed steel; $H_{T.\ 650\ C}$	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; tempered at 650 C for 30 min and cooled in air.
31	189	L	1934	357-534	2.0-5.0	High speed steel; $H_{T.\ 700\ C}$	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; tempered at 700 C for 30 min and cooled in air.
32	189	L	1934	366-538	2.0-5.0	High speed steel; $H_{T.\ 800\ C}$	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; tempered at 800 C for 30 min and cooled in air.

SPECIFICATION TABLE NO. 346 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	W	C	Cr	Cu	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
							Composition (weight per cent)									
33	189	L	1934	363-530	2.0-5.0	High speed steel; H_A	15.53	0.605	3.29		Trace		0.028	0.073	0.075	1.13 V; annealed at 830 C.
34	189	L	1934	360-413	2.0-5.0	High speed steel; I_Q	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; oil-quenched from 1300 C.
35	189	L	1934	357-417	2.0-5.0	High speed steel; $I_{T.200\ C}$	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; tempered at 200 C for 30 min and cooled in air.
36	189	L	1934	364-496	2.0-5.0	High speed steel; $I_{T.300\ C}$	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; tempered at 300 C for 30 min and cooled in air.
37	189	L	1934	366-477	2.0-5.0	High speed steel; $I_{T.400\ C}$	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; tempered at 400 C for 30 min and cooled in air.
38	189	L	1934	366-529	2.0-5.0	High speed steel; $I_{T.500\ C}$	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; tempered at 500 C for 30 min and cooled in air.
39	189	L	1934	368-532	2.0-5.0	High speed steel; $I_{T.550\ C}$	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; tempered at 550 C for 30 min and cooled in air.
40	189	L	1934	367-530	2.0-5.0	High speed steel; $I_{T.600\ C}$	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; tempered at 600 C for 30 min and cooled in air.
41	189	L	1934	362-531	2.0-5.0	High speed steel; $I_{T.650\ C}$	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; tempered at 650 C for 30 min and cooled in air.
42	189	L	1934	364-537	2.0-5.0	High speed steel; $I_{T.700\ C}$	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; tempered at 700 C for 30 min and cooled in air.
43	189	L	1934	369-543	2.0-5.0	High speed steel; $I_{T.800\ C}$	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; tempered at 800 C for 30 min and cooled in air.
44	189	L	1934	359-533	2.0-5.0	High speed steel; I_A	15.05	0.705	3.24	0.047	0.169		Trace	0.026	0.166	Trace Ti, 0.864 V; annealed at 830 C.
45	189	L	1934	363-389	2.0-5.0	T_Q	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; water-quenched from 840 C.
46	189	L	1934	362-391	2.0-5.0	$T_{T.150\ C}$	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; tempered at 150 C for 30 min and cooled in air.
47	189	L	1934	377-430	2.0-5.0	$T_{T.200\ C}$	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; tempered at 200 C for 30 min and cooled in air.
48	189	L	1934	365-468	2.0-5.0	$T_{T.250\ C}$	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; tempered at 250 C for 30 min and cooled in air.

SPECIFICATION TABLE NO. 346 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	W	C	Cr	Cu	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
							Composition (weight per cent)									
49	189	L	1934	370-493	2.0-5.0	$T_{T.\,300\,C}$	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; tempered at 300 C for 30 min and cooled in air.
50	189	L	1934	368-544	2.0-5.0	$T_{T.\,350\,C}$	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; tempered at 350 C for 30 min and cooled in air.
51	189	L	1934	369-546	2.0-5.0	$T_{T.\,400\,C}$	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; tempered at 400 C for 30 min and cooled in air.
52	189	L	1934	374-548	2.0-5.0	$T_{T.\,500\,C}$	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; tempered at 500 C for 30 min and cooled in air.
53	189	L	1934	377-543	2.0-5.0	$T_{T.\,600\,C}$	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; tempered at 600 C for 30 min and cooled in air.
54	189	L	1934	372-547	2.0-5.0	$T_{T.\,700\,C}$	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; tempered at 700 C for 30 min and cooled in air.
55	189	L	1934	371-545	2.0-5.0	T_A	1.02	1.03	0.102		0.997		0.033	0.042	0.215	0.110 Ni; annealed at 780 C.
56	166	C	1939	273-573		High speed steel; 18	18.45	0.715	4.26	0.064	0.25	Trace	0.018	0.028	0.30	0.067 Ni, 0.004 Al, 0.035 As, 1.075 V; annealed at 830 C.
57	129	C	1933	373-773	3.0-5.0	S_4	1.04	0.35	0.61		0.75		0.035	0.028	0.22	0.17 Ni; normalized at 900 C.
58	212	L	1941	423-623		High speed steel; TM-1	5.0/ 6.0	0.83	1.0			3.5/ 5.5				1.40 - 1.75 V.
59	212	L	1941	423-823		High speed steel; 18-4-1	16.00	0.70	4.0		0.30				0.25	1.0 V, annealed.
60	340	L	1956	420-796	7.0	High speed steel, T-1	18.0		4.0							1.0 V; annealed.
61	340	L	1956	454-841	7.0	High speed steel, M-2	6.0		4.0			5.0				2.0 V; annealed.
62	340	L	1956	348-833	7.0	Tool material; CA-4										Composition unknown; cast iron grade; containing tungsten carbide and a small amount of cobalt binder.
63	340	L	1956	360-660	7.0	Tool material; K-6										Same as the above specimen.
64	340	L	1956	415-819	7.0	Tool material; CA-2										Composition unknown: steel cutting grade; containing tungsten carbide, titanium carbide and tantalum carbide, and an increased amount of cobalt than the above two specimens, CA-4 and K-6.
65	340	L	1956	395-935	7.0	Tool material; K-2s										Same as the above specimen.

SPECIFICATION TABLE NO. 346 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	W	C	Cr	Cu	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
							Composition (weight per cent)									
66	327	CL	1943	673.2		IV a	3.14	0.28	1.67			1.55				Cast, forged, annealed at 700 C for 2 hrs, quenched in oil at 900 up to 1200 C in steps of 50 C, and then annealed again from 400 C to 650 C in 30 min.
67	327	CL	1943	673.2		IV b	4.90	0.29	1.50			1.57				Same as the above specimen.
68	327	CL	1943	673.2		V a	3.00	0.28	1.45							0.62 V; preparation same as the above specimen.
69	327	CL	1943	673.2		V b	5.02	0.27	1.50							0.60 V; preparation same as the above specimen.
70	327	CL	1943	673.2		VII a	2.85	0.28	1.51			0.90				0.54 V; preparation same as the above specimen.
71	327	CL	1943	673.2		VII b	3.11	0.28	1.52			1.94				0.54 V; preparation same as the above specimen.
72	327	CL	1943	673.2		VII c	3.09	0.26	1.41			2.90				0.54 V; preparation same as the above specimen.
73	327	CL	1943	673.2		VIII a	5.02	0.25	1.42			1.04				0.57 V; preparation same as the above specimen.
74	327	CL	1943	673.2		VIII b	4.73	0.25	1.43			1.96				0.54 V; preparation same as the above specimen.
75	327	CL	1943	673.2		VIII c	5.14	0.27	1.35			2.89				0.41 V; preparation same as the above specimen.
76	539	L	1938	356-1092		HS steel	18.52	0.70	4.40		0.32	0.51	0.027	0.004	0.11	0.84 V, 0.06 Co; annealed.
77	539	L	1938	338-823			18.52	0.70	4.40		0.32	0.51	0.027	0.004	0.11	0.84 V, 0.06 Co; the above specimen heated to 1320 C and quenched in oil.
78	539	L	1938	333-811			18.52	0.70	4.40		0.32	0.51	0.027	0.004	0.11	0.84 V, 0.06 Co; the above specimen tempered at 550 C for 40 min and cooled in furnace.
79	539	L	1938	340-804			18.52	0.70	4.40		0.32	0.51	0.027	0.004	0.11	0.84 V, 0.06 Co; the above specimen tempered again at 550 C for 40 min.
80	539	L	1938	342-1099			18.52	0.70	4.40		0.32	0.51	0.027	0.004	0.11	0.84 V, 0.06 Co; the above specimen tempered again at 550 C for 40 min.
81	539	L	1938	330-1099		High speed steel	19.31	0.77	4.35		0.23	0.91	0.026	0.003	0.14	2.03 V, 5.58 Co; annealed.
82	539	L	1938	338-590			19.31	0.77	4.35		0.23	0.91	0.026	0.003	0.14	2.03 V, 5.58 Co; the above specimen heated to 1330 C and quenched in oil.
83	539	L	1938	333-800			19.31	0.77	4.35		0.23	0.91	0.026	0.003	0.14	2.03 V, 5.58 Co; the above specimen tempered at 550 C for 40 min and cooled in furnace.
84	539	L	1938	328-790			19.31	0.77	4.35		0.23	0.91	0.026	0.003	0.14	2.03 V, 5.58 Co; the above specimen tempered again at 550 C for 40 min.
85	539	L	1938	351-1088			19.31	0.77	4.35		0.23	0.91	0.026	0.003	0.14	2.03 V, 5.58 Co; the above specimen tempered again at 550 C for 40 min.

SPECIFICATION TABLE NO. 346 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	W	C	Cr	Cu	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
86	986, 987	E	1963	312-920	<3	R15										Quenched and tempered; measured during heating; electrical conductivity 1.09, 1.04, 1.00, 0.951, 0.902, 0.852, 0.829, 0.810, 0.799, and 0.776 x 10^{-4} ohm^{-1} cm^{-1} at 37, 126, 200, 282, 381, 445, 500, 558, 598, and 654 C, respectively.
87	986, 987	E	1963	347-920	<3	R15										The above specimen measured during cooling; electrical resistivity 1.63, 1.47, 1.36, 1.31, 1.23, 1.10, 0.971, 0.923, 0.877, 0.826, and 0.776 x 10^{-4} ohm^{-1} cm^{-1} at 72, 153, 204, 235, 281, 373, 457, 500, 552, 600, and 654 C, respectively.
88	986, 987	E	1963	369-916	<3	R15Kh3	15.06	0.81	2.80							1.55 V; quenched at 1250 C; tempered three times at 560 C; measured during heating; electrical resistivity 1.41, 1.39, 1.30, 1.11, 1.08, and 0.973 x 10^{-4} ohm^{-1} cm^{-1} at 47, 134, 234, 429, 546, and 652 C, respectively.
89	986, 987	E	1963	398-916	<3	R15Kh3										The above specimen measured during cooling; electrical resistivity 1.90, 1.50, 1.32, 1.11, 1.05, and 0.973 x 10^{-4} ohm^{-1} cm^{-1} at 154, 325, 436, 556, 597, and 652 C, respectively.
90	986, 987	E	1963	399-671	<3	R15Kh3										Same composition and heat treatment as the above specimen.
91	986, 987	E	1963	316-909	<3	R15Kh3K5	15.13	0.85	2.96							5.05 Co, 1.40 V; quenched at 1250 C, tempered at 580 C.
92	986, 987	E	1962	305-783	<3	R15Kh3K5										Similar to the above specimen.
93	986, 987	E	1963	323-877	<3	R15Kh3K10	15.16	0.78	2.85							9.50 Co, 1.45 V; quenched at 1250 C, tempered at 580 C.
94	986, 987	E	1963	330-995	<3	R15Kh3K12	14.90	0.77	3.3							11.74 Co, 1.59 V; quenched at 1250 C, tempered at 580 C; measured during heating.

SPECIFICATION TABLE NO. 346 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	W	C	Cr	Cu	Mn	Mo	P	S	Si	Composition (continued), Specifications and Remarks
95	986, 987	E	1963	417-995	<3	R15Kh3K12										The above specimen measured during cooling.
96	986, 987	E	1963	348-840	<3	R15Kh3K12										Same composition and heat treatment as the above specimen.
97	986, 987	E	1963	361-974	<3	R15Kh4	14.76	0.83	4.13							1.59 V; Quenched at 1250 C, tempered three times at 560 C; electrical resistivity 1.93, 1.80, 1.66, 1.57, 1.40, 1.29, 1.18, 1.10, 1.01, and 0.972 x 10^{-4} ohm^{-1} cm^{-1} at 38, 91, 153, 200, 306, 381, 450, 515, 569, and 649 C, respectively.
98	986, 987	E	1963	314-753	<3	R7	7.94	0.79	4.10							1.69 V; quenched at 1200 C, tempered three times at 560 C; electrical resistivity 2.14, 1.82, 1.68, 1.23, and 1.22 x 10^{-4} ohm^{-1} cm^{-1} at 39, 153, 215, 481, and 508 C, respectively.
99	986, 987	E	1963	309-794	<3	R10	9.52	0.81	4.28							1.40 V; quenched at 1220 C, tempered three times at 560 C; electrical resistivity 2.08, 1.82, 1.57, 1.39, 1.22, and 1.23 x 10^{-4} ohm^{-1} cm^{-1} 46, 141, 249, 337, 457, and 523 C, respectively.
100	986, 987	E	1963	308-790	<3	R12	12.25	0.84	4.13							1.55 V; quenched at 1240 C, tempered three times at 560 C; electrical resistivity 2.13, 1.71, 1.47, and 1.15 x 10^{-4} ohm^{-1} cm^{-1} at 39, 214, 318, and 525 C, respectively.
101	986, 987	E	1963	311-668	<3	R18	18.80	0.75	3.98							1.09 V; quenched at 1280 C, tempered three times at 560 C; electrical resistivity 1.85, 1.73, 1.44, and 1.21 x 10^{-4} ohm^{-1} cm^{-1} at 43, 97, 243, and 400 C, respectively.

DATA TABLE NO. 346 THERMAL CONDUCTIVITY OF (IRON + TUNGSTEN + ΣX_i) ALLOYS GROUP II

(At least one X 0% or if any of Mn, P, S, Si > 0.60%)

[Temperature, T, K; Thermal Conductivity, k, Watts $cm^{-1}K^{-1}$]

CURVE 1

T	k
366.20	0.163
390.70	0.157
411.20	0.167

CURVE 2

T	k
368.20	0.163
395.20	0.167
419.70	0.163

CURVE 3

T	k
358.20	0.180
384.20	0.184
416.70	0.180
455.20	0.184
477.20	0.184
503.20	0.188

CURVE 4

T	k
366.70	0.184
391.20	0.176
423.20	0.180
446.20	0.188
484.20	0.180
503.70	0.188
525.70	0.184

CURVE 5

T	k
363.20	0.188
387.70	0.193
421.20	0.188
447.70	0.197
475.70	0.197
504.20	0.201
526.70	0.201

CURVE 6

T	k
362.20	0.226
401.20	0.222
430.20	0.222
449.20	0.226

CURVE 6 (cont.)

T	k
484.20	0.230
502.70	0.230
534.70	0.234

CURVE 7

T	k
369.20	0.222
393.70	0.218
420.70	0.226
451.70	0.226
475.70	0.230
503.70	0.230
543.70	0.234

CURVE 8*

T	k
365.20	0.222
385.70	0.226
425.70	0.230
454.20	0.234
484.20	0.226
507.20	0.234
532.70	0.230

CURVE 9

T	k
372.70	0.234
391.70	0.230
423.70	0.234
444.20	0.239
475.20	0.243
515.20	0.234
538.20	0.247

CURVE 10

T	k
368.20	0.264
394.20	0.264
428.70	0.268
446.70	0.272
476.70	0.272
512.70	0.272
532.70	0.276

CURVE 11

T	k
368.20	0.268
390.20	0.272
417.20	0.280
446.20	0.280
473.20	0.276
505.20	0.280
537.70	0.276

CURVE 12*

T	k
370.20	0.163
400.70	0.163
418.70	0.167

CURVE 13

T	k
367.70	0.159
382.20	0.163
418.20	0.167

CURVE 14*

T	k
365.20	0.184
393.70	0.188
416.20	0.180
444.20	0.184
461.20	0.188
499.20	0.184

CURVE 15

T	k
368.20	0.188
408.70	0.184
435.20	0.184
464.70	0.193
497.20	0.193
514.70	0.197
539.70	0.197

CURVE 16

T	k
371.20	0.193
396.20	0.197
415.20	0.197

CURVE 16 (cont.)

T	k
453.20	0.201
480.20	0.205
513.70	0.205
535.20	0.213

CURVE 17

T	k
365.70	0.218
386.70	0.213
422.70	0.218
444.70	0.222
471.20	0.218
506.70	0.226
526.20	0.230

CURVE 18*

T	k
359.20	0.218
390.20	0.213
423.20	0.218
446.70	0.218
475.70	0.226
495.70	0.230
532.70	0.226

CURVE 19*

T	k
367.70	0.226
394.20	0.222
422.70	0.226
445.20	0.234
475.20	0.230
522.20	0.239
530.70	0.239

CURVE 20

T	k
365.20	0.230
389.20	0.239
417.70	0.239
445.20	0.239
467.70	0.247
507.70	0.243
541.70	0.247

CURVE 21

T	k
368.70	0.255
393.20	0.259
416.20	0.259
447.20	0.264
474.20	0.264
498.70	0.272
535.20	0.268

CURVE 22*

T	k
370.20	0.264
391.20	0.272
427.20	0.276
447.70	0.272
482.20	0.272
500.70	0.280
546.70	0.285

CURVE 23*

T	k
358.70	0.172
395.70	0.176
425.20	0.176

CURVE 24

T	k
361.20	0.176
385.70	0.172
425.20	0.176

CURVE 25*

T	k
[illegible]	0.188
[illegible]	0.188
4[illegible].20	0.197
442.70	0.193
476.70	0.197
499.20	0.197

CURVE 26*

T	k
365.20	0.197
355.20	0.193
423.20	0.193

CURVE 26 (cont.)

T	k
443.70	0.197
466.20	0.201
497.20	0.197
525.70	0.201

CURVE 27

T	k
359.70	0.197
393.20	0.205
416.20	0.205
450.20	0.201
474.70	0.209
506.20	0.213
535.20	0.213

CURVE 28*

T	k
365.20	0.226
397.20	0.226
425.70	0.230
453.70	0.230
481.70	0.230
515.20	0.234
534.70	0.234

CURVE 29*

T	k
370.20	0.226
398.70	0.230
417.20	0.226
449.20	0.234
478.20	0.234
509.20	0.230
537.20	0.239

CURVE 30*

T	k
368.70	0.239
404.70	0.234
419.20	0.239
452.70	0.239
472.20	0.234
500.70	0.243
534.20	0.247

CURVE 31

T	k
357.20	0.239
398.70	0.247
420.20	0.243
452.20	0.251
483.20	0.255
507.70	0.251
533.70	0.247

CURVE 32*

T	k
366.20	0.276
391.20	0.272
424.70	0.27[illegible]
441.20	0.[illegible]76
471.20	[illegible].280
504.70	0.272
538.20	0.276

CURVE 33

T	k
363.20	0.285
387.70	0.297
414.70	0.293
450.20	0.289
480.70	0.293
504.20	0.297
530.20	0.297

CURVE 34*

T	k
360.20	0.184
394.20	0.180
413.20	0.188

CURVE 35*

T	k
357.20	0.180
383.20	0.188
417.20	0.184

CURVE 36*

T	k
364.20	0.201
394.70	0.197

CURVE 36 (cont.)

T	k
414.20	0.205
448.20	0.201
474.20	0.205
496.20	0.20[illegible]

CURVE 37*

T	k
366.20	0.205
3[illegible]5.20	0.201
429.20	0.205
453.70	0.209
476.70	0.209
496.20	0.213
477.20	0.213

CURVE 38

T	k
366.20	0.205
391.20	0.213
418.20	0.218
445.20	0.213
472.20	0.209
502.70	0.218
529.20	0.213

CURVE 39*

T	k
368.20	0.234
387.20	0.239
420.70	0.243
447.20	0.239
479.70	0.247
508.20	0.243
531.70	0.239

CURVE 40*

T	k
366.70	0.243
390.20	0.239
423.70	0.239
446.20	0.243
477.20	0.247
496.70	0.243
530.20	0.239

* Not shown on plot

DATA TABLE NO. 316 (continued)

T	k
CURVE 41*	
361.7	0.255
394.2	0.251
416.7	0.259
443.7	0.255
480.2	0.255
505.2	0.259
530.7	0.259
CURVE 42*	
364.2	0.289
390.2	0.293
419.7	0.297
447.2	0.297
477.7	0.293
509.7	0.297
537.2	0.297
CURVE 43	
368.7	0.322
393.7	0.314
415.2	0.318
449.7	0.322
476.7	0.326
511.7	0.322
542.7	0.318
CURVE 44	
359.2	0.341
390.2	0.339
421.2	0.335
450.2	0.339
477.7	0.343
512.2	0.339
533.2	0.343
CURVE 45	
363.2	0.301
378.7	0.305
389.2	0.310
CURVE 46*	
361.7	0.310
377.7	0.314
390.7	0.314
CURVE 47*	
378.7	0.326
405.7	0.322
429.7	0.326
CURVE 48	
364.7	0.372
389.7	0.372
418.2	0.377
442.7	0.368
468.2	0.372
CURVE 49	
370.2	0.372
394.2	0.385
422.2	0.381
451.7	0.377
469.7	0.377
493.2	0.381
CURVE 50*	
358.2	0.372
402.7	0.372
431.2	0.381
460.2	0.372
497.2	0.372
519.6	0.377
544.2	0.368
CURVE 51	
369.2	0.393
400.7	0.389
423.2	0.385
457.7	0.389
489.2	0.393
517.2	0.389
545.7	0.385
CURVE 52*	
374.2	0.393
402.7	0.385
436.2	0.385
452.2	0.389
491.7	0.385
521.7	0.389
548.2	0.377
CURVE 53*	
377.2	0.381
401.2	0.385
434.2	0.385
460.2	0.381
487.2	0.365
523.2	0.365
543.2	0.372
CURVE 54*	
372.2	0.398
397.7	0.385
431.7	0.393
451.7	0.385
479.2	0.389
519.2	0.389
546.7	0.381
CURVE 55*	
370.7	0.385
393.7	0.393
418.2	0.393
450.7	0.385
476.7	0.389
518.2	0.385
545.2	0.369
CURVE 56	
273.2	0.243
323.2	0.251
373.2	0.259
423.2	0.266
473.2	0.272
CURVE 56 (cont.)	
523.2	0.276
573.2	0.280
CURVE 57	
373.2	0.385
473.2	0.371
573.2	0.363
673.2	0.352
773.2	0.341
CURVE 58	
423.2	0.203
473.2	0.210
573.2	0.223
673.2	0.236
773.2	0.249
823.2	0.256
CURVE 59	
423.2	0.209
473.2	0.214
573.2	0.226
673.2	0.239
773.2	0.251
823.2	0.258
CURVE 60	
419.7	0.356
422.3	0.352
501.3	0.355
515.8	0.370
515.8	0.380
538.7	0.350
542.6	0.350
549.2	0.373
551.8	0.378
660.1	0.353
660.1	0.362
695.2	0.328
701.2	0.325
750.9	0.365
750.8	0.377
CURVE 60 (cont.)	
792.9	0.345
796.2	0.347
CURVE 61	
453.7	0.321
459.6	0.324
543.7	0.332
549.2	0.336
567.9	0.334
572.3	0.348
577.7	0.331
603.7	0.337
609.6	0.334
718.7	0.321
733.2	0.316
733.2	0.331
824.1	0.321
831.4	0.333
840.8	0.315
CURVE 62	
348.4	1.11
355.4	1.19
379.0	1.03
381.8	1.06
410.3	1.09
417.9	1.14
452.6	1.02
456.2	1.01
484.8	0.999
530.4	0.967
535.6	0.956
563.7	0.937
565.1	0.922
584.3	0.948
605.4	0.937
630.4	0.892
698.4	0.854
710.1	0.824
736.2	0.871
799.9	0.828
833.2	0.809
CURVE 63	
359.6	0.873
363.7	0.850
374.8	0.850
379.0	0.854
388.7	0.824
393.0	0.839
445.7	0.798
448.4	0.790
473.4	0.764
479.6	0.783
480.4	0.798
534.5	0.783
535.9	0.756
540.1	0.771
574.8	0.715
640.1	0.696
659.6	0.719
CURVE 64	
415.1	0.515
416.5	0.530
446.5	0.500
488.7	0.504
506.8	0.523
509.6	0.506
515.1	0.497
553.4	0.497
565.1	0.489
580.9	0.493
637.3	0.489
656.8	0.493
709.6	0.463
767.9	0.467
819.3	0.463
CURVE 65	
395.1	0.485
399.0	0.474
402.6	0.467
412.3	0.470
480.4	0.485
483.2	0.470
519.3	0.485
CURVE 65 (cont.)	
547.1	0.482
588.7	0.491
592.9	0.484
622.1	0.493
647.1	0.487
655.4	0.476
656.8	0.464
692.9	0.478
699.8	0.485
706.8	0.478
727.7	0.478
737.3	0.489
754.0	0.482
760.1	0.493
781.8	0.482
800.7	0.485
845.1	0.482
856.8	0.465
862.3	0.502
928.4	0.493
934.6	0.485
CURVE 66*	
673.2	0.2929
CURVE 67*	
673.2	0.2887
CURVE 68*	
673.2	0.3012
CURVE 69*	
673.2	0.2887
CURVE 70*	
673.2	0.3054
CURVE 71*	
673.2	0.3012
CURVE 72*	
673.2	0.2971
CURVE 73*	
673.2	0.2887
CURVE 74*	
673.2	0.2887
CURVE 75*	
673.2	0.2887
CURVE 76	
358.2	0.351*
386.2	0.344*
404.2	0.344*
531.2	0.336*
607.2	0.337*
716.2	0.326*
785.2	0.313
903.2	0.324
980.2	0.315
1092.2	0.302
CURVE 77*	
338.2	0.206
410.2	0.240
499.2	0.243
581.2	0.262
627.2	0.269
674.2	0.248
705.2	0.250
823.2	0.251
CURVE 78*	
333.2	0.248
376.2	0.262
476.2	0.274
591.2	0.290
644.2	0.290
726.2	0.270
811.2	0.270

* Not shown on plot

DATA TABLE NO. 346 (continued)

T	k
CURVE 79*	
340.2	0.241
379.2	0.244
482.2	0.272
572.2	0.290
665.2	0.275
762.2	0.265
804.2	0.272
CURVE 80*	
342.2	0.234
380.2	0.269
596.2	0.292
660.2	0.286
803.2	0.283
866.2	0.276
975.2	0.258
1099.2	0.264
CURVE 81*	
330.2	0.318
381.2	0.312
518.2	0.313
858.2	0.312
698.2	0.303
798.2	0.294
979.2	0.294
1008.2	0.292
1098.2	0.277
CURVE 82*	
338.2	0.176
394.2	0.218
502.2	0.235
590.2	0.251
CURVE 83*	
333.2	0.218
403.2	0.269
497.2	0.269
660.2	0.268
735.2	0.259
800.2	0.256
CURVE 84*	
328.2	0.228
377.2	0.238
509.2	0.277
580.2	0.274
670.2	0.276
730.2	0.264
790.2	0.255
CURVE 85*	
351.2	0.229
401.2	0.252
489.2	0.272
576.2	0.275
690.2	0.285
783.2	0.267
818.2	0.273
928.2	0.260
1019.2	0.254
1088.2	0.255
CURVE 86	
312.2	0.106
399.2	0.131
473.2	0.167
555.2	0.189
652.2	0.226
772.2	0.246*
824.2	0.258*
920.2	0.286
CURVE 87*	
347.2	0.105
422.2	0.167
483.2	0.173
554.2	0.197
643.2	0.233
772.2	0.262
850.2	0.271
920.2	0.288
CURVE 88*	
368.2	0.148
408.2	0.179
CURVE 88 (cont.)*	
506.2	0.191
697.2	0.254
813.2	0.289
916.2	0.341
CURVE 89*	
388.2	0.187
453.2	0.213
598.2	0.248
708.2	0.300
825.2	0.308
868.2	0.341
916.2	0.341
CURVE 90*	
399.2	0.211
473.2	0.231
564.2	0.255
671.2	0.277
CURVE 91	
316.2	0.151
349.2	0.159
421.2	0.172
704.2	0.261
793.2	0.297
857.2	0.364
909.2	0.410
CURVE 92*	
305.2	0.214
386.2	0.251
486.2	0.261
545.2	0.289
673.2	0.312
783.2	0.354
CURVE 93	
323.2	0.146
378.2	0.177*
569.2	0.213
720.2	0.286*
CURVE 93 (cont.)	
814.2	0.364
877.2	0.466
CURVE 94*	
330.2	0.134
348.2	0.151
368.2	0.159
456.2	0.177
523.2	0.196
752.2	0.298
828.2	0.356
895.2	0.410
950.2	0.451
995.2	0.472
CURVE 95	
417.2	0.275*
552.2	0.314
773.2	0.388
923.2	0.434
950.2	0.451
995.2	0.472
CURVE 96*	
348.2	0.210
435.2	0.232
569.2	0.300
840.2	0.369
CURVE 97*	
361.2	0.206
473.2	0.217
573.2	0.249
721.2	0.282
833.2	0.324
974.2	0.367
CURVE 98*	
314.2	0.214
410.2	0.266
423.2	0.269
482.2	0.276
CURVE 98 (cont.)	
604.2	0.315
687.2	0.343
753.2	0.376
CURVE 99	
309.2	0.213
523.2	0.257*
723.2	0.286
794.2	0.308
CURVE 100	
308.2	0.223
481.2	0.236*
582.2	0.244
669.2	0.251
790.2	0.280
CURVE 101*	
311.2	0.193
365.2	0.201
511.2	0.213
668.2	0.244

* Not shown on plot

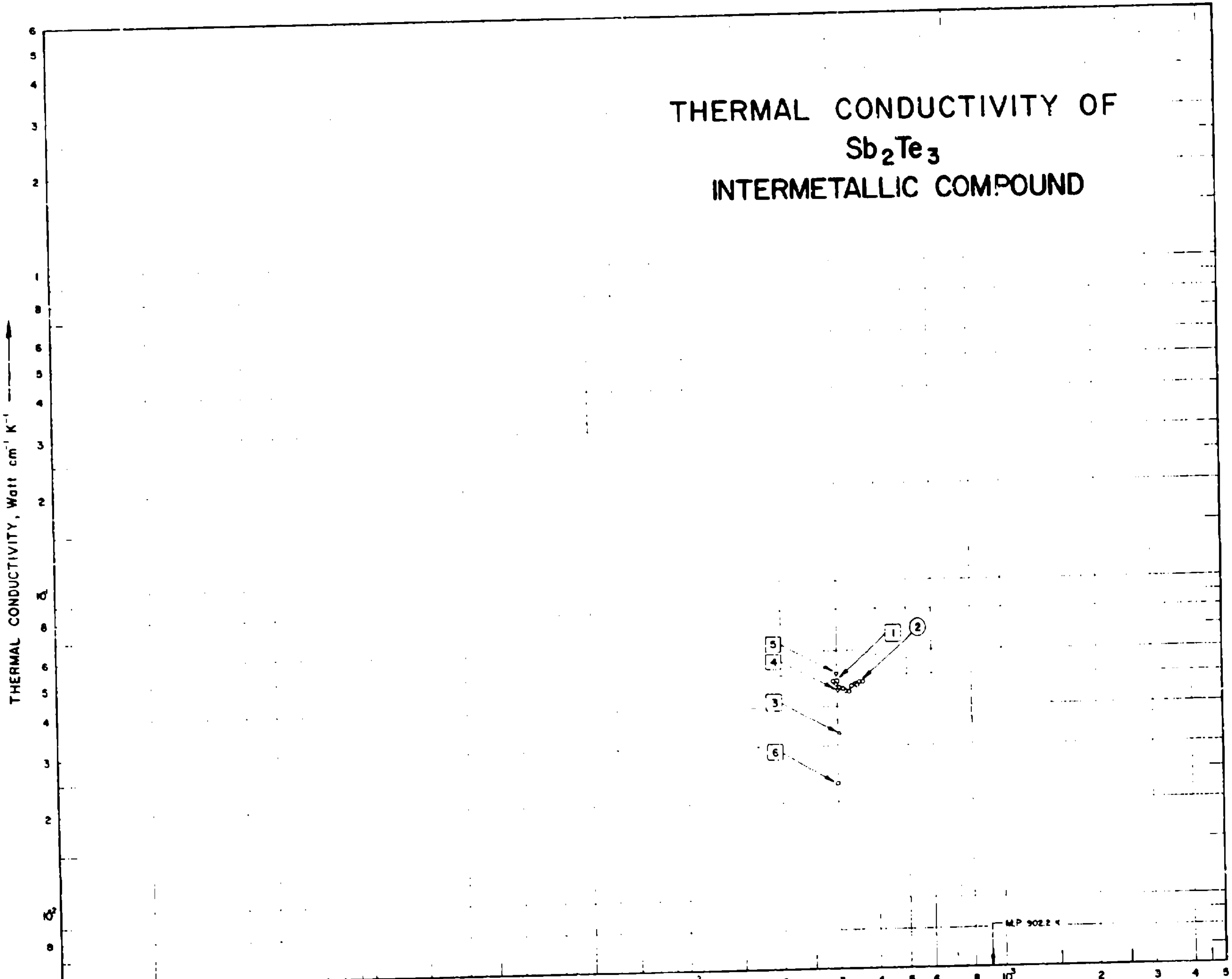

THERMAL CONDUCTIVITY OF
Sb2Te3
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm-1 K-1
TEMPERATURE, K
M.P. 902.2 K
1
2
3
4
5
6

FIG 347

SPECIFICATION TABLE NO. 347 THERMAL CONDUCTIVITY OF Sb_2Te_3 INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 347]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	521	C	1957	300		Sb_2Te_3	p-type, excess Sb; rhombohedral crystal; hole concentration 70 x 10^{18} cm^{-3}; prepared by sintering, annealing, and crystallizing by Bridgeman technique.
2	585	L	1961	293-363		Sb_2Te_3	Polycrystal; cylindrical specimen; current carriers 10^{20} cm^{-3}.
3	832		1962	303.2		Sb_2Te_3	p-type; prepared from 99.99' pure elements by cold-pressing -60 mesh powder at 35 tsi and sintering at 450 C for 3 hrs in Argon; heat flow perpendicular to pressing direction; electrical resistivity 0.78 x 10^{-3} ohm cm and 1.09 x 10^{-3} ohm cm at 100-400 C and 150-450 C, respectively.
4	833		1962	303.2		Sb_2Te_3	p-type; prepared from 99.99' pure elements by cold-pressing -60 mesh powder at 35 tsi and sintering at 500 C for 3 hrs in Argon; heat flow perpendicular to pressing direction; electrical resistivity 0.21 x 10^{-3} ohm cm and 0.61 x 10^{-3} ohm cm at 30 C and 150-450 C, respectively.
5	936	T	1965	298.2		Sb_2Te_3	2.58 Te excess (calculated); p-type; 0.5 x 0.5 x 1 cm; prepared from 99.999 Sb supplied by Consolidated Mining and Smelting Co., and from 99.97 Te, supplied by Canadian Copper Refiners, Ltd., materials weighed out, crushed, sealed in an ampule in a vacuum of 10^{-5} Torr, heated at 900 C for 20 hrs, rocked, cooled, zone-melted at a rate of 0.07-0.28 in. hr^{-1}, then cooled and cut; thermal conductivity data calculated from measured values of figure of merit, Seebeck coefficient, and electrical conductivity; electrical conductivity reported as 4.33 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
6	936	T	1965	298.2		Sb_2Te_3	Cut from the same ingot as the above specimen; electrical conductivity reported as 4.33 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.

DATA TABLE NO. 347 THERMAL CONDUCTIVITY OF Sb_2Te_3 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
300	0.048
CURVE 2	
293.2	0.0481
298.2	0.0473
300.7	0.0464*
305.7	0.0456
315.2	0.0452
320.2	0.0446
328.2	0.0446
335.7	0.0460
343.2	0.0469
348.2	0.0464
355.7	0.0477
363.2	0.0477
CURVE 3	
303.2	0.033
CURVE 4	
303.2	0.0449
CURVE 5	
298.2	0.0505
CURVE 5	
298.2	0.0229

*Not shown on plot

SPECIFICATION TABLE NO. 348 THERMAL CONDUCTIVITY OF As_2Te_3 INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	521	C	1957	300		As_2Te_3	N-type (excess Te, I); electron concentration 18 x 10^{18} cm^{-3} at 300 K; monoclinic structure a = 14.4 Å, b = 4.05 Å, c = 9.92 Å, and β = 97; prepared by verticle zone melting.
2	521	C	1957	300		As_2Te_3	Similar to the above specimen except p-type (excess As); hole concentration 40 x 10^{18} cm^{-3} at 300 K.

DATA TABLE NO. 348 THERMAL CONDUCTIVITY OF As_2Te_3 INTERMETALLIC COMPOUNDS

[Temperature, T, K, Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
300	0.025
CURVE 2*	
300	0.027

* No graphical presentation

SPECIFICATION TABLE NO. 349 THERMAL CONDUCTIVITY OF Ba_2Pb INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	548	L	1961	298.2		Ba_2Pb; No. 1	Seebeck coeff. 14.6 $\mu v K^{-1}$ at 25 C; electrical resistivity 2.46 x 10^{-4} ohm cm at 25 C; figure of merit 0.305 x 10^{-4} K^{-1} at 25 C.
2	548	L	1961	298.2		Ba_2Pb; No. 3	Seebeck coeff. 133.5 $\mu v K^{-1}$ at 25 C; electrical resistivity 1.37 x 10^{-2} ohm cm at 25 C; figure of merit 0.893 x 10^{-4} K^{-1} at 25 C.
3	548	L	1961	298.2		Ba_2Pb; No. 4	Seebeck coeff. 37.7 $\mu v K^{-1}$ at 25 C; electrical resistivity 1.54 x 10^{-3} ohm cm at 25 C; figure of merit 0.83 x 10^{-4} K^{-1} at 25 C.

DATA TABLE NO. 349 THERMAL CONDUCTIVITY OF Ba_2Pb INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.0284
CURVE 2*	
298.2	0.0147
CURVE 3*	
298.2	0.0111

* No graphical presentation

SPECIFICATION TABLE NO. 350 THERMAL CONDUCTIVITY OF Ba_2Sn INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	548	L	1961	298.2		Ba_2Sn; No. 3	Seebeck coeff. 14.2 μ v K^{-1} at 25 C; electrical resistivity 1.70 x 10^{-3} ohm cm at 25 C; figure of merit 0.27 x 10^{-3} K^{-1} at 25 C.
2	548	L	1961	298.2		Ba_2Sn; No. 4	1.0 mole percent excess Ba; Seebeck coeff. 19.7 μ v K^{-1} at 25 C; electrical resistivity 1.40 x 10^{-2} ohm cm at 25 C; figure of merit 0.303 x 10^{-3} K^{-1} at 25 C.

DATA TABLE NO. 350 THERMAL CONDUCTIVITY OF Ba_2Sn INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.00437
CURVE 2*	
298.2	0.00912

* No graphical presentation

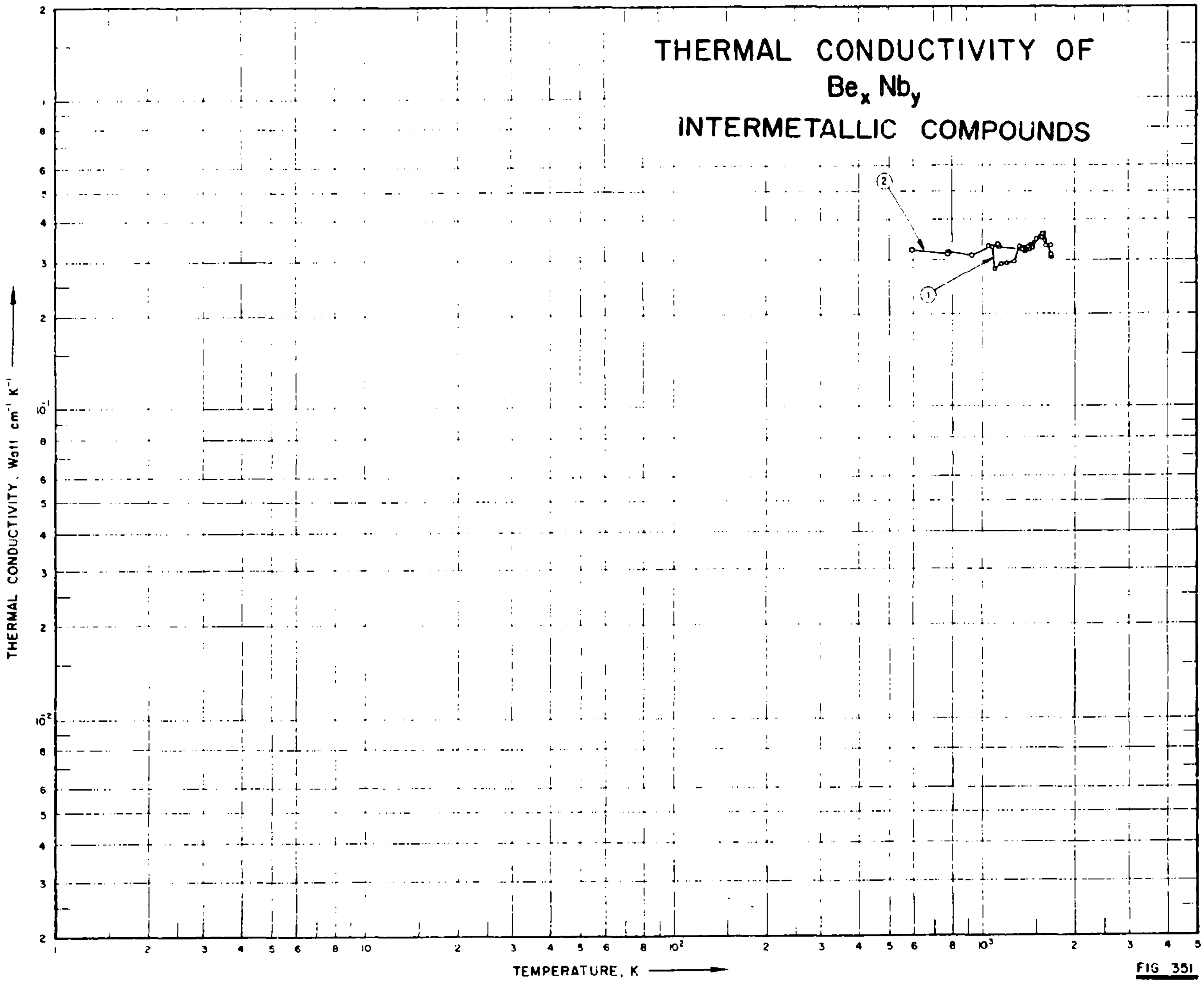

THERMAL CONDUCTIVITY OF
$Be_x Nb_y$
INTERMETALLIC COMPOUNDS
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 351

SPECIFICATION TABLE NO. 351 THERMAL CONDUCTIVITY OF $Be_x Nb_y$ INTERMETALLIC COMPOUNDS

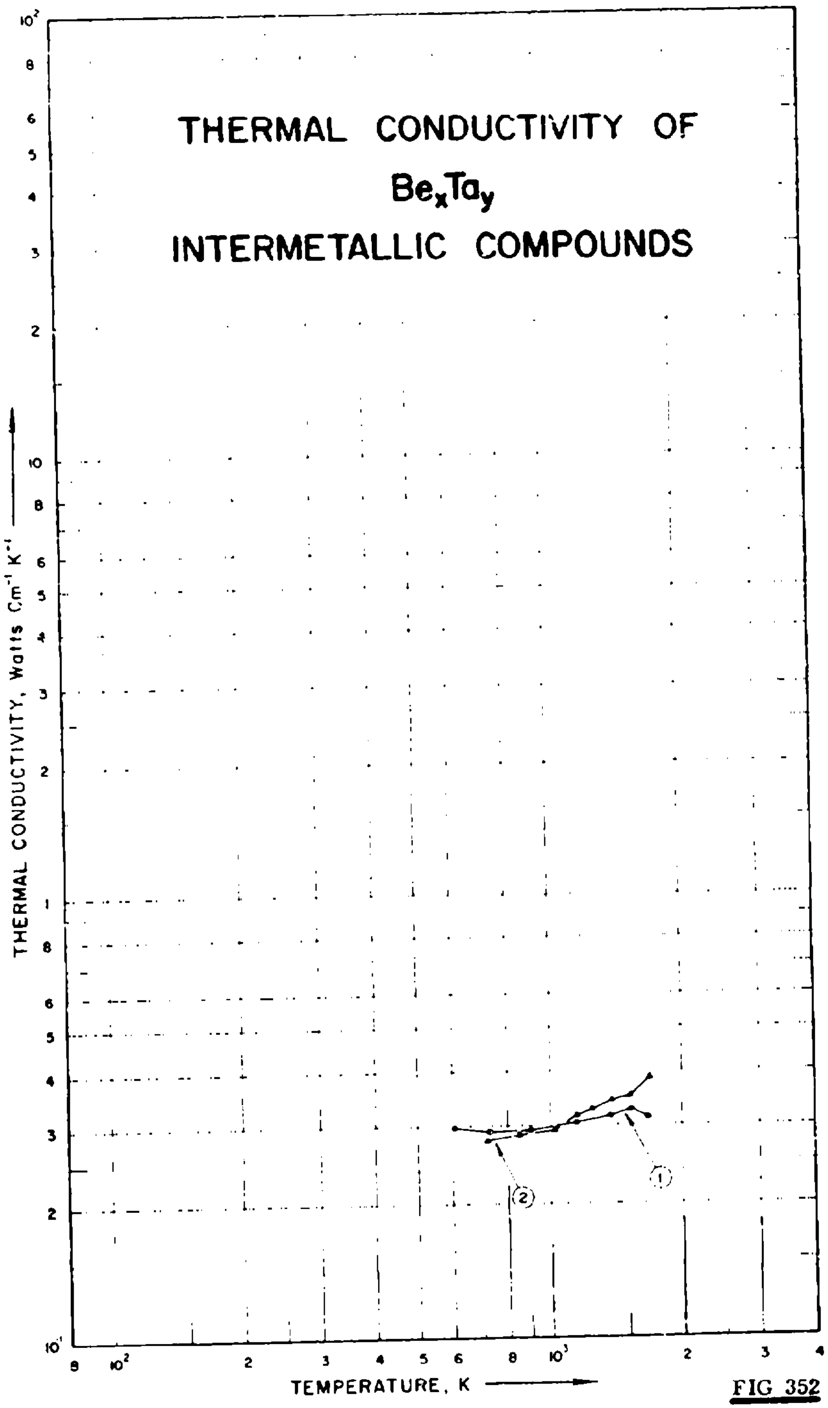
[For Data Reported in Figure and Data Table No. 351]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	446	R	1959	1052-1691		$Be_{12}Nb$	Prepared from Be (99.3 pure) supplied by Brush Beryllium Co. and Nb (< 99.5 pure) supplied by Kawecki Chemical Co.; cylindrical specimen 2.5 in. dia, 2.5 in. high; prepared by hot pressing powdered $NbBe_{12}$ at 2000 psi and 2700 to 2800 F for 1 to 2 hrs.
2	938	R	1962	596-1699	5	$Be_{17}Nb_2$	Specimen consists of five vertically stacked cylinders, each 2.625 in. O.D. and 1 in. high with a 0.25 in. bore concentric with the axis; fabricated by cold pressing and sintering from $Be_{17}Nb_2$ powder; density 3.23 g cm^{-3}.

DATA TABLE NO. 351 THERMAL CONDUCTIVITY OF Be_xNb_y INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
1051.5	0.325
1085.9	0.322
1104.3	0.282
1165.4	0.292
1203.2	0.294
1283.2	0.298
1345.9	0.334
1422.1	0.320
1430.4	0.325
1475.4	0.308
1514.3	0.350
1579.3	0.355
1634.3	0.324
1690.9	0.325
CURVE 2	
596	0.324
774	0.315
775	0.317
930	0.313
1144	0.336
1146	0.332
1367	0.327
1368	0.322
1368	0.327
1596	0.350
1597	0.360
1699	0.310
1699	0.312



THERMAL CONDUCTIVITY OF
Be_xTa_y
INTERMETALLIC COMPOUNDS
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}
TEMPERATURE, K
1
2

FIG 352

SPECIFICATION TABLE NO. 352 THERMAL CONDUCTIVITY OF Be_xTa_y INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 352]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	583	R	1962	608-1689	5.0	Ta_2Be_{17}	Single phase; 98% of absolute density.
2	594	R	1961	721-1698	5.0	$TaBe_{12}$	Specimen consisted of 5 hollow cylinders, each 2-5/8 in. O.D., 1/4 in. I.D. and 1 in. high.

DATA TABLE NO. 352 THERMAL CONDUCTIVITY OF Be_xTa_y INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
698.2	0.288
609.3	0.303*
732.1	0.291
732.6	0.291*
905.9	0.292
1156.5	0.305
1156.5	0.332*
1377.6	0.315
1378.2	0.315*
1547.8	0.325
1548.2	0.324*
1688.7	0.312
1689.3	0.312*
CURVE 2	
726.9	0.279
724.8	0.279
857.6	0.287
862.6	0.287*
1021.5	0.292
1033.2	0.292*
1162.1	0.318
1166.5	0.315*
1255.4	0.329
1257.6	0.325*
1385.9	0.343
1397.1	0.337*
1397.1	0.343*
1533.2	0.351
1544.3	0.357*
1697.6	0.386

* Not shown on plot

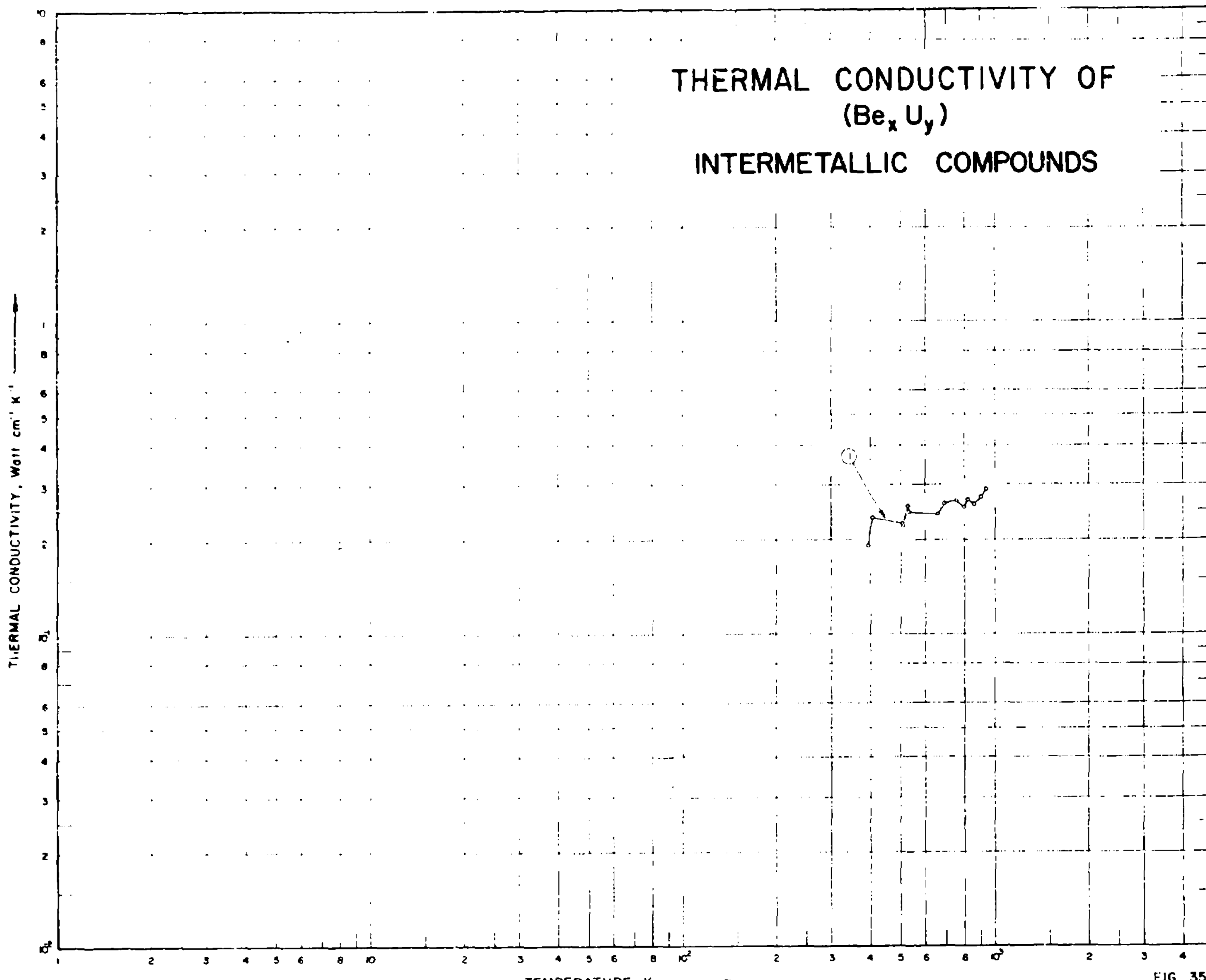

THERMAL CONDUCTIVITY OF
$(Be_x U_y)$
INTERMETALLIC COMPOUNDS
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1

FIG 353

SPECIFICATION TABLE NO. 353 THERMAL CONDUCTIVITY OF $Be_x U_y$ INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 353]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	556	C	1959	295-940		UBe_{13}	Solid-Solid reaction of UH_3 and powdered Be in an induction furnace under 1 argon atmosphere at 1550 C and sintered; x-ray density 4.37 g cm^{-3}.

DATA TABLE NO. 353 THERMAL CONDUCTIVITY OF Be_xU_y INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
395.2	0.192
406.2	0.236
506.2	0.225
510.7	0.220
528.2	0.258
533.2	0.246
659.2	0.242
693.2	0.262
756.2	0.267
798.2	0.256
823.2	0.269
861.2	0.260
905.2	0.274
940.2	0.290

SPECIFICATION TABLE NO. 354 THERMAL CONDUCTIVITY OF $Be_{13}Zr$ INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	446	R	1959	983-1657		$Be_{13}Zr$	Prepared from Be (99.3 pure) supplied by Brush Beryllium Co. and ZrH_2 (98.5$^+$ pure) supplied by Metal Hydrides Inc.; cylindrical specimen 0.5 in. dia, 2.5 in. long; prepared by hot pressing powdered $ZrBe_{13}$ at 2000 psi and 2700 to 2800 F for 2 to 2.50 hr.

DATA TABLE NO. 354 THERMAL CONDUCTIVITY OF $Be_{13}Zr$ INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 1 (cont.)*	
983.1	0.402	1614.3	0.350
1025.4	0.391	1657.1	0.343
1085.4	0.337		
1089.8	0.318		
1158.2	0.358		
1198.2	0.391		
1210.4	0.381		
1237.1	0.379		
1289.8	0.405		
1299.3	0.322		
1348.2	0.388		
1380.9	0.360		
1393.2	0.369		
1395.4	0.331		
1395.9	0.346		
1459.3	0.341		
1517.6	0.382		
1540.4	0.370		
1573.2	0.382		
1610.9	0.306		

* No graphical presentation

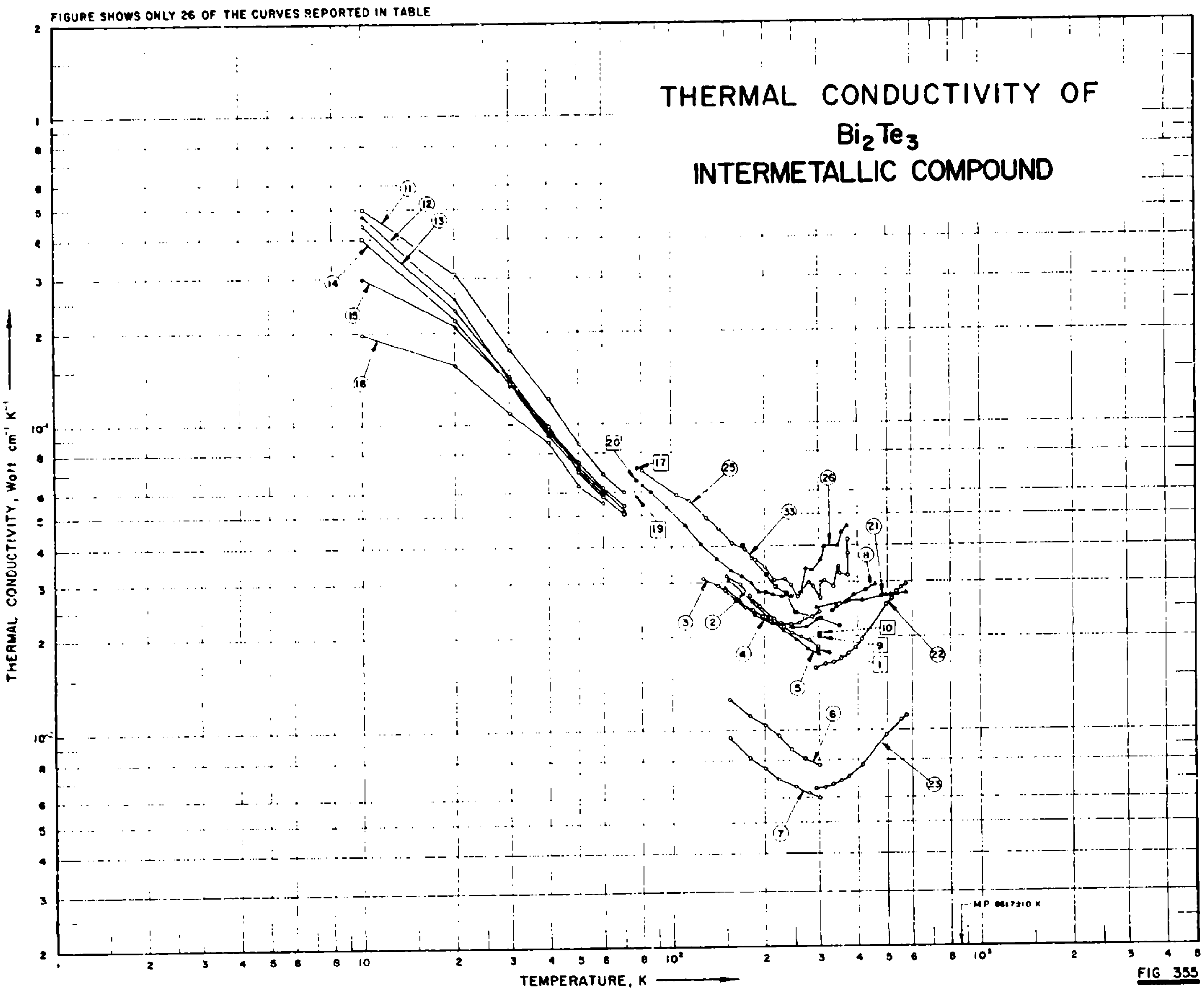


FIGURE SHOWS ONLY 26 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
Bi2Te3
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
MP 861±10 K
1
2
3
4
5
6
7
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
25
26
33

FIG 355

SPECIFICATION TABLE NO. 355 THERMAL CONDUCTIVITY OF Bi_2Te_3 INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 355]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	368	L, C	1954	298.2	0.2-3.0	Bi_2Te_3	Fine crystalline structure; extruded; current carriers 6.8×10^{18} cm^{-3}; 15 mm dia, 1 to 3 mm thick; electrical conductivity 1500 ohm^{-1} cm^{-1} at 25 C.
2	332	L	1956	150-300	~2	Bi_2Te_3, No. 1	n-type; cut from impure end of zone refined bar; rectangular specimen; heat flow parallel to zoning direction and the cleavage plane; electrical conductivity 750 ohm^{-1} cm^{-1} at room temperature.
3	332	L	1956	127-300	~2	Bi_2Te_3, No. 2	n-type; intrinsic; zone refined; rectangular specimen; cut from the same bar as the above specimen; heat flow and zoning direction parallel to the cleavage plane; electrical conductivity 200 ohm^{-1} cm^{-1} at room temperature.
4	332	L	1956	150-293	~2	Bi_2Te_3, No. 3	Similar to the above specimen (adjacent specimen).
5	332	L	1956	152-300	~2	Bi_2Te_3, No. 4	p-type single crystal; heat flow parallel to the cleavage plane; electrical conductivity 500 ohm^{-1} cm^{-1} at room temperature.
6	332	L	1956	154-300	~2	Bi_2Te_3, No. 5	p-type single crystal; heat flow perpendicular to the cleavage plane; electrical conductivity 500 ohm^{-1} cm^{-1} at room temperature.
7	332	L	1956	154-390	~2	Bi_2Te_3, No. 6	Similar to the above specimen.
8	326	C	1960	333-457		Bi_2Te_3	p-type polycrystalline specimen; prepared from Asarco 99.999+ pure Bi and 99.999+ Te; prepared by fusing in vacuo, hexagonal unit cell with constants of: a = 4.37 Å and c = 30.62 Å; specimen 12 mm dia and 6 mm thick; electrical conductivity ~10^3 ohm^{-1} cm^{-1}; Armco iron used as reference; measured in vacuo of ~10^{-6} mm Hg.
9	325	T	1959	300	1	Bi_2Te_3; 3b	p-type; electrical resistivity 1.90×10^{-3} ohm cm.
10	325	T	1959	300	1	Bi_2Te_3; 17a	p-type; electrical resistivity 1.07×10^{-3} ohm cm.
11	311	L	1960	10-70	5	Bi_2Te_3; SBTC 18	p-type single crystal; form factor (F = length/cross-sectional area) = 30.4; measured in a vacuo of < 5×10^{-5} mm Hg.
12	311	L	1960	10-70	5	Bi_2Te_3; SBTC 19	p-type single crystal; doped with I, final concentration 0.027; F = 25.3; measured in a vacuum of < 5×10^{-5} mm Hg.
13	311	L	1960	10-70	5	Bi_2Te_3; SBTC 27	n-type single crystal; doped with I, final concentration 0.037; F = 30.0; measured in a vacuum of < 5×10^{-5} mm Hg.
14	311	L	1960	10-70	5	Bi_2Te_3; SBTC 16	n-type single crystal; doped with I, final concentration 0.046; F = 24.0; measured in a vacuum of < 5×10^{-5} mm Hg.
15	311	L	1960	10-60	5	Bi_2Te_3; SBTC 15	n-type single crystal; doped with I, final concentration 0.059; F = 52.8; measured in a vacuum of < 5×10^{-5} mm Hg.
16	311	L	1960	10-60	5	Bi_2Te_3; SBTC 10	n-type single crystal; doped with I, final concentration 0.124; F = 34.0; measured in a vacuum of < 5×10^{-5} mm Hg.
17	386	L	1958	77		Bi_2Te_3, S 22	p-type single crystal; undoped; measured in a magnetic field parallel to the crystal axis; heat flow perpendicular to the crystal axis.

SPECIFICATION TABLE NO. 355 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
18	386	L	1958	77		Bi_2Te_3, S 21	Similar to the above specimen.
19	386	L	1958	77		Bi_2Te_3; S 17	n-type single crystal; doped with 0.055 I (nominal); magnetic field parallel to the crystal axis, heat flow perpendicular to the crystal axis.
20	386	L	1958	77		Bi_2Te_3, S 15	Similar to the above specimen except doped with 0.09 I.
21	387	P	1960	293-573	±20	Bi_2Te_3, 68	p-type, measured in a 1.95 MEV electron beam, heat flow parallel to crystal planes; electrical resistivity ~5.1 x 10^{-4} ohm cm at room temperature.
22	387	P	1960	293-573	±20	Bi_2Te_3; 64	p-type, measured in a 1.95 MEV electron beam; heat flow perpendicular to the crystal planes; ρ ~ 9.6 x 10^{-4} ohm cm at room temperature.
23	387	P	1960	293-573	±20	Bi_2Te_3; 59	Similar to the above specimen except ρ ~ 13.8 x 10^{-4} ohm cm at room temperature.
24	387	P	1960	293-573	±20	Bi_2Te_3, 69	n-type; measured in a 1.95 MEV electron beam; heat flow perpendicular to the crystal planes; ρ ~ 6.5 x 10^{-4} ohm cm at room temperature.
25	388	L	1957	80-370		Bi_2Te_3	p-type single crystal; specimen 0.5 x 0.5 x 2.5 cm, prepared by zone melting from Bi (99.999 pure, supplied by Cerro de Paco Corp.) and Te (99.999 pure, supplied by American Smelting and Refining Co.); 2 x 10^{19} excess holes cm^{-3}.
26	388	L	1957	80-370		Bi_2Te_3; D-13	n-type single crystal; specimen 0.5 x 0.5 x 2.5 cm, prepared from Bi (99.999 pure, supplied by Cerro de Paco Corp.) and Te (99.999 pure, supplied by American Smelting and Refining Co.); 3 x 10^{17} excess electrons cm^{-3}.
27	549	L	1959	311.2	±10	Bi_2Te_3	Supplied by Electronic System Laboratory, M.I.T.
28	521	C	1957	300		Bi_2Te_3	n-type (excess Te, I); electron concentration 5 x 10^{18} cm^{-3} at 300 K; rhombohedral structure (a_0 = 10.45 Å and α = 24° 8'); prepared by zone melting, quenching and annealing.
29	521	C	1957	300		Bi_2Te_3	p-type (excess Bi, Pb); hole concentration 8 x 10^{18} cm^{-3} at 300 K; structure and specimen similar to the above.
30	386	L	1958	77		Bi_2Te_3; S 11	n-type single crystal; doped with (nominal) 0.40 I; heat flow perpendicular to the crystal axis, a magnetic field parallel to the crystal axis.
31	936	T	1965	298.2		Bi_2Te_3	2.03 Te excess (calculated); n-type, 0.5 x 0.5 x 1 cm; prepared from 99.999 pure Bi supplied by Consolidated Mining and Smelting Co. and from 99.9+ pure Te supplied by Canadian Copper Refiners, Ltd., materials weighed out, crushed, sealed in an ampule in a vacuum of 10^{-5} Torr, heated at 900 C for 20 hrs, rocked, cooled, zone-melted at a rate of 0.07 - 0.28 in. hr^{-1}, then cooled and cut; thermal conductivity data calculated from measured values of figure of merit, Seebeck coefficient, and electrical conductivity; electrical conductivity reported as 1.78 x 10^3 ohm^{-1} cm^{-1} at room temperature.
32	936	T	1965	298.2		Bi_2Te_3	Cut from the same ingot as the above specimen; electrical conductivity reported as 1.75 x 10^3 ohm^{-1} cm^{-1} at room temperature.
33	936	T	1965	170-351		Bi_2Te_3	Similar to the above specimen except electrical resistivity reported as 244, 267, 309, 360, 389, 454, 517, 582, and 721 µohm cm at 171, 183, 203, 219, 239, 256, 281, 304, and 350 K, respectively.

SPECIFICATION TABLE NO. 355 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
34	936	T	1965	298.2		Bi_2Te_3	Similar to the above specimen except electrical conductivity reported as 1.29×10^3 $ohm^{-1}\,cm^{-1}$ at room temperature.
35	936	T	1965	298.2		$Bi_2Te_{3.08}$	0.95 Te excess (calculated); n-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 0.24×10^3 $ohm^{-1}\,cm^{-1}$ at room temperature.

DATA TABLE NO. 355 THERMAL CONDUCTIVITY OF Bi_2Te_3 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
298.2	0.0180
CURVE 2	
150.0	0.0315
166.7	0.0295
178.9	0.0271
192.2	0.0253
213.0	0.0232
230.0	0.0216
245.9	0.0207
261.5	0.0200
278.5	0.0195
298.9	0.0185
CURVE 3	
127.4	0.0309
141.1	0.0292
148.1	0.0282
161.9	0.0264
173.0	0.0251
184.4	0.0246
196.3	0.0235
209.6	0.0226
225.2	0.0223
243.7	0.0221
259.6	0.0224
269.6	0.0231
285.2	0.0234
300.0	0.0242
CURVE 4	
149.6	0.0287
166.7	0.0261
185.6	0.0238
211.1	0.0225
247.0	0.0215
272.2	0.0216
293.3	0.0228
CURVE 5	
152.6	0.0307
181.9	0.0261
205.9	0.0234
230.0	0.0210
250.4	0.0196
276.3	0.0182
300.0	0.0176
CURVE 6	
153.7	0.0126
177.8	0.0112
200.0	0.0104
221.1	0.00956
244.4	0.00869
265.3	0.00804
300.0	0.00771
CURVE 7	
153.7	0.00949
177.8	0.00818
200.0	0.00753
224.1	0.00695
251.9	0.00655
275.9	0.00622
300.0	0.00600
CURVE 8	
333.0	0.0243
341.3	0.0251
365.0	0.0259
389.1	0.0272
427.4	0.0282
456.6	0.0293
CURVE 9	
300	0.0199
CURVE 10	
300	0.0206
CURVE 11	
10	0.500
20	0.313
30	0.175
40	0.122
50	0.086
60	0.069
70	0.060
CURVE 12	
10	0.440
20	0.235
30	0.143
40	0.096
50	0.075
60	0.062
70	0.054
CURVE 13	
10	0.476
20	0.256
30	0.140
40	0.094
50	0.073
60	0.061
70	0.052
CURVE 14	
10	0.400
20	0.220
30	0.137
40	0.098
50	0.070
60	0.058
70	0.051
CURVE 15	
10	0.299
20	0.208
30	0.136*
40	0.091
50	0.071
60	0.059
CURVE 16	
10	0.196
20	0.156
30	0.109
40	0.083
50	0.063
60	0.055
CURVE 17	
77	0.072
CURVE 18*	
77	0.072
CURVE 19	
77	0.056
CURVE 20	
77	0.066
CURVE 21	
293.2	0.0250
373.2	0.0260
413.2	0.0262
473.2	0.0268
493.2	0.0270
513.2	0.0272
533.2	0.0274
573.2	0.0276
CURVE 22	
293.2	0.0159
313.2	0.0163
333.2	0.0165
353.2	0.0170
373.2	0.0176
393.2	0.0184
413.2	0.0197
493.2	0.0256
513.2	0.0266
533.2	0.0278
553.2	0.0287
573.2	0.0295
CURVE 23	
293.2	0.00650
313.2	0.00653
333.2	0.00670
353.2	0.00690
373.2	0.00710
393.2	0.00730
413.2	0.00775
493.2	0.00963
553.2	0.0107
573.2	0.0111
CURVE 24*	
293.2	0.00272
413.2	0.00314
493.2	0.00335
573.2	0.00398
CURVE 25	
80.0	0.0708
103.1	0.0588
114.3	0.056
129.0	0.049
142.9	0.0452
156.3	0.041
172.4	0.039
CURVE 25 (cont.)	
185.9	0.036
200.0	0.034
213.7	0.0305
232.6	0.0308
243.9	0.0295
255.1	0.027
277.8	0.030
285.7	0.0290
301.2	0.0268
303.0	0.030
312.5	0.0305
333.3	0.029
347.2	0.0340
349.7	0.0322
370.4	0.0318
370.4	0.038
370.4	0.042
CURVE 26	
80.1	0.0635
85.5	0.060
96.6	0.053
110.9	0.0465
123.8	0.0410
140.1	0.0365
156.3	0.033
169.5	0.0315
181.2	0.0298
192.3	0.0278
204.1	0.0278
213.7	0.0274
228.8	0.0270
243.9	0.0270
264.6	0.0278
271.7	0.0335
285.7	0.0330
303.0	0.0360
310.6	0.0398
344.8	0.040
350.9	0.044
370.4	0.046
CURVE 27*	
311.2	0.016
CURVE 28*	
300	0.021
CURVE 29*	
300	0.021
CURVE 30*	
77	0.076
CURVE 31*	
298.2	0.0234
CURVE 32*	
298.2	0.0229
CURVE 33	
170.4	0.0402
182.1	0.0364
202.0	0.0319
217.9	0.0290
236.4	0.0278
253.2	0.0243
281.7	0.0235*
304.0	0.0232
350.9	0.0217
CURVE 34*	
298.2	0.0240
CURVE 35*	
298.2	0.0220

* Not shown on plot

SPECIFICATION TABLE NO. 356 THERMAL CONDUCTIVITY OF B_xSi_y INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	962	C	1963	339-441	± 4	SiB_4	0.5 Ca, 0.5 Cu, 0.430 O, 0.2 Al, 0.2 Fe, 0.2 W, 0.1 Co, 0.1 Ni, 0.072 H, 0.07 Au, 0.04 Cr, 0.02 Mg, 0.014 N, 0.01 Mn, and 0.01 Ti; polycrystalline; 0.5 in.^{2} x 0.875 in. long; prepared from amorphous boron of grade A-200 mesh supplied by Cooper Metallurgical Associates and 99.97 pure silicon of -200 mesh supplied by Union Carbide Corp., materials (2 Si to 1 B by weight) reacted in a dry argon atmosphere at a temperature not exceeding 1330 C for 4 hrs, the boride powders were cold-pressed at 100,000 psi, then hot-pressed for 3-4 hrs at 1350 C and 6000 psi in a graphite die with carbon impregnated graphite plungers, machined into rectangular bar; bulk density 1.94 g cm^{-3}; porosity 20%; electrical conductivity reported as 0.437, 0.617, 0.904, 1.32, 1.50, 3.93, 6.49, 8.75, 15.4, 17.7, 21.1, and 28.2 ohm^{-1}cm^{-1} at 386, 407, 433, 478, 490, 610, 699, 756, 885, 962, 990, and 1075 K, respectively; polycrystalline alumina with 8 to 10% porosity used as comparative material; data corrected to zero porosity.
2	962	C	1963	336-437		SiB_6	0.410 O, 0.2 Al, 0.2 Ca, 0.2 Cu, 0.064 H, 0.02 Fe, 0.015 N, 0.01 Ni, 0.01 Ti, < 0.01 Mn, and 0.005 Mg; polycrystalline; 0.5 in.^{2} x 0.875 in. long; prepared from amorphous boron of grade A-200 mesh supplied by Cooper Metallurgical Associates and 99.97 pure silicon of -200 mesh supplied by Union Carbide Corp., materials (2 Si to 1 B by weight) blended in a tungsten carbide mortor and pestle and pressed at 20,000 psi into cylindrical compacts without binder, then reacted in closed boron nitride crucibles containing a maximum of 1.5% B_2O_3 and within a graphite induction furnace at 1630 C for 4 hrs, dry argon was fed into the furnace chamber during reaction, the boride powders were prepressed at 100,000 psi, then hot-pressed for 2 hrs at 1500 C and 6000 psi, machined into rectangular bar; bulk density 2.12 g cm^{-3}; porosity 15%; electrical conductivity reported as 6.46, 18.1, 35.7, 60.3, 80.5, and 91.6 ohm^{-1}cm^{-1} at 299, 382, 429, 532, 575, and 585 K, respectively; polycrystalline alumina with 8 to 10% porosity used as comparative material; data corrected to zero porosity.

DATA TABLE NO. 356 THERMAL CONDUCTIVITY OF B_xSi_y INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
339.2	0.0946
378.2	0.0904
411.2	0.0837
441.2	0.0766
CURVE 2*	
336.2	0.0954
373.2	0.0925
412.2	0.0849
437.2	0.0766

* No graphical presentation

FIGURE SHOWS ONLY 7 OF THE CURVES REPORTED IN TABLE

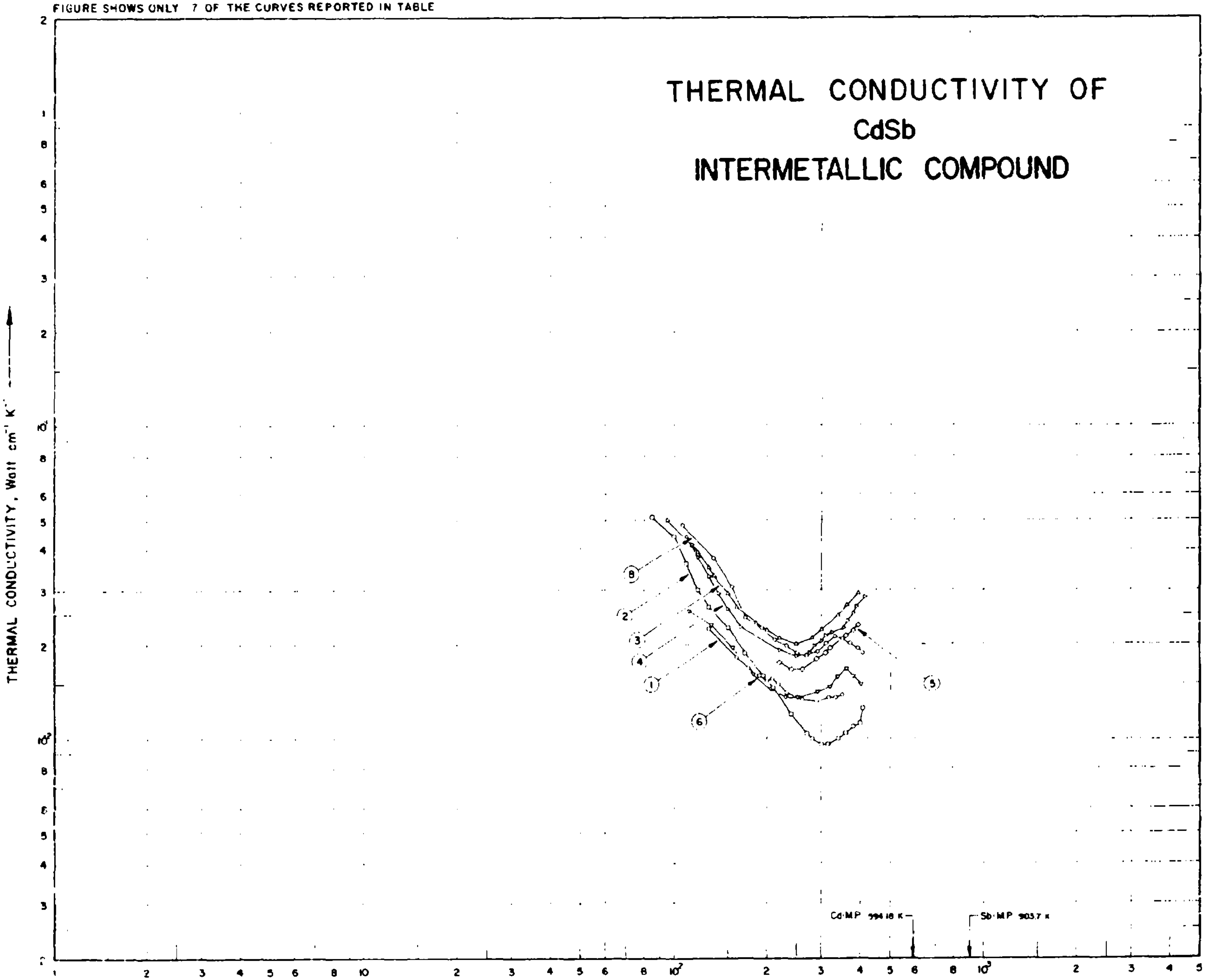


FIG 357

SPECIFICATION TABLE NO. 357 THERMAL CONDUCTIVITY OF CdSb INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 357]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	823		1963	130-350		CdSb	No details reported.
2	824	L	1962	85-410		CdSb, No. 1	p-type; polycrystalline specimen; electrical conductivity 0.6 $ohm^{-1} cm^{-1}$ at room temperature.
3	824	L	1962	110-395		CdSb, No. 2	p-type; single crystal grown by zone recrystallization; electrical conductivity 0.71 $ohm^{-1} cm^{-1}$ at room temperature; heat flow normal to the [112] plane of the crystal.
4	824	L	1962	95-415		CdSb, No. 3	As above but the electrical conductivity, 0.68 $ohm^{-1} cm^{-1}$ at room temperature.
5	824	L	1962	220-395		CdSb, No. 4	As above but the electrical conductivity, 0.54 $ohm^{-1} cm^{-1}$ at room temperature.
6	940, 941	L	1964	113-491		CdSb, 1	p-type single crystal; high purity Cd and Sb obtained by triple vacuum fractional distillation followed by zone refining, specimen ingot grown by the zone recrystallization method; measured in a vacuum of 10^{-3} - 10^{-4} mm Hg; heat flow parallel to the [100] direction.
7	940, 941	L	1964	112-406		CdSb, 2	Cut from the same ingot as the above specimen; heat flow parallel to the [010] direction.
8	940, 941	L	1964	107-408		CdSb, 3	Cut from the same ingot as the above specimen; heat flow parallel to the [001] direction.
9	940, 941	L	1964	106-413		CdSb, 4	Similar to the above specimen, heat flow parallel to the [100] direction.
10	940, 941	L	1964	106-391		CdSb, 5	Cut from the same ingot as the above specimen, heat flow parallel to the [010] direction.
11	940, 941	L	1964	106-411		CdSb, 6	Cut from the same ingot as the above specimen; heat flow parallel to the [001] direction.

DATA TABLE NO. 357 THERMAL CONDUCTIVITY OF CdSb INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
130	0.0224
160	0.0182
175	0.0168
190	0.0159
200	0.0153
207	0.0156
217	0.0149
222	0.0140
260	0.0134
290	0.0132
317	0.0136
335	0.0136
350	0.0138
CURVE 2	
85	0.0510
100	0.0444
110	0.0360
120	0.0301
130	0.0264
150	0.0226
170	0.0188
195	0.0159
210	0.0146
240	0.0121
270	0.0105
280	0.0100
300	0.0096
315	0.0096
340	0.0100
360	0.0105
380	0.0109
400	0.0113
410	0.0126
CURVE 3	
110	0.0444
120	0.0393
130	0.0351
135	0.0331
150	0.0292
160	0.0264
CURVE 3 (cont.)	
185	0.0234
200	0.0222
220	0.0209
250	0.0201
280	0.0209
300	0.0222
340	0.0247
365	0.0268
395	0.0293
CURVE 4	
95	0.0502
115	0.0418
120	0.0377
130	0.0331
140	0.0292
150	0.0259
165	0.0226
220	0.0192
250	0.0184
275	0.0188
285	0.0197
300	0.0205
310	0.0213
325	0.0218
355	0.0226
365	0.0238
380	0.0251
390	0.0264
415	0.0285
CURVE 5	
220	0.0176
240	0.0167
260	0.0167
290	0.0180
310	0.0188
320	0.0196
360	0.0213
380	0.0221
395	0.0230
CURVE 6	
113	0.0255
132	0.0229
156	0.0195
181	0.0161
206	0.0144
230	0.0136
252	0.0136
292	0.0141
319	0.0146
339	0.0157
361	0.0167
381	0.0158
401	0.0149
CURVE 7*	
112	0.0439
124	0.0393
134	0.0364
142	0.0323
151	0.0299
161	0.0292
180	0.0245
222	0.0202
241	0.0194
262	0.0188
291	0.0194
314	0.0205
336	0.0203
351	0.0195
370	0.0192
393	0.0182
406	0.0191
CURVE 8	
107	0.0482
135	0.0374
154	0.0306
171	0.0243
192	0.0225
212	0.0206
232	0.0198
251	0.0188
CURVE 8 (cont.)	
269	0.0185
292	0.0189
313	0.0201
333	0.0211
351	0.0207
372	0.0201
395	0.0194
408	0.0187
CURVE 9*	
106	0.0281
119	0.0251
138	0.0223
158	0.0205
178	0.0177
199	0.0157
221	0.0136
239	0.0132
259	0.0130
280	0.0131
315	0.0127
332	0.0130
353	0.0129
371	0.0135
394	0.0141
413	0.0140
CURVE 10*	
106	0.0470
126	0.0401
141	0.0331
154	0.0279
177	0.0227
198	0.0200
222	0.0190
241	0.0183
260	0.0183
291	0.0183
309	0.0191
331	0.0198
352	0.0200
377	0.0195
391	0.0187
CURVE 11*	
106	0.0477
123	0.0407
139	0.0337
157	0.0282
179	0.0235
199	0.0210
216	0.0197
237	0.0190
287	0.0187
309	0.0196
328	0.0205
349	0.0210
373	0.0208
395	0.0198
411	0.0190

* Not shown on plot

SPECIFICATION TABLE NO. 357 THERMAL CONDUCTIVITY OF CdSb INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 357]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	823		1963	130-350		CdSb	No details reported.
2	824	L	1962	85-410		CdSb, No. 1	p-type; polycrystalline specimen; electrical conductivity 0.6 $ohm^{-1} cm^{-1}$ at room temperature.
3	824	L	1962	110-395		CdSb, No. 2	p-type; single crystal grown by zone recrystallization; electrical conductivity 0.71 $ohm^{-1} cm^{-1}$ at room temperature; heat flow normal to the [112] plane of the crystal.
4	824	L	1962	95-415		CdSb, No. 3	As above but the electrical conductivity, 0.68 $ohm^{-1} cm^{-1}$ at room temperature.
5	824	L	1962	220-395		CdSb, No. 4	As above but the electrical conductivity, 0.54 $ohm^{-1} cm^{-1}$ at room temperature.
6	940, 941	L	1964	113-401		CdSb; 1	p-type single crystal; high purity Cd and Sb obtained by triple vacuum fractional distillation followed by zone refining, specimen ingot grown by the zone recrystallization method; measured in a vacuum of 10^{-3} - 10^{-4} mm Hg; heat flow parallel to the [100] direction.
7	940, 941	L	1964	112-406		CdSb; 2	Cut from the same ingot as the above specimen; heat flow parallel to the [010] direction.
8	940, 941	L	1964	107-408		CdSb; 3	Cut from the same ingot as the above specimen; heat flow parallel to the [001] direction.
9	940, 941	L	1964	106-413		CdSb; 4	Similar to the above specimen; heat flow parallel to the [100] di[illegible]
10	940, 941	L	1964	106-391		CdSb; 5	Cut from the same ingot as the above specimen; heat flow parallel to the [010] direction.
11	940, 941	L	1964	106-411		CdSb; 6	Cut from the same ingot as the above specimen; heat flow parallel to the [001] direction.

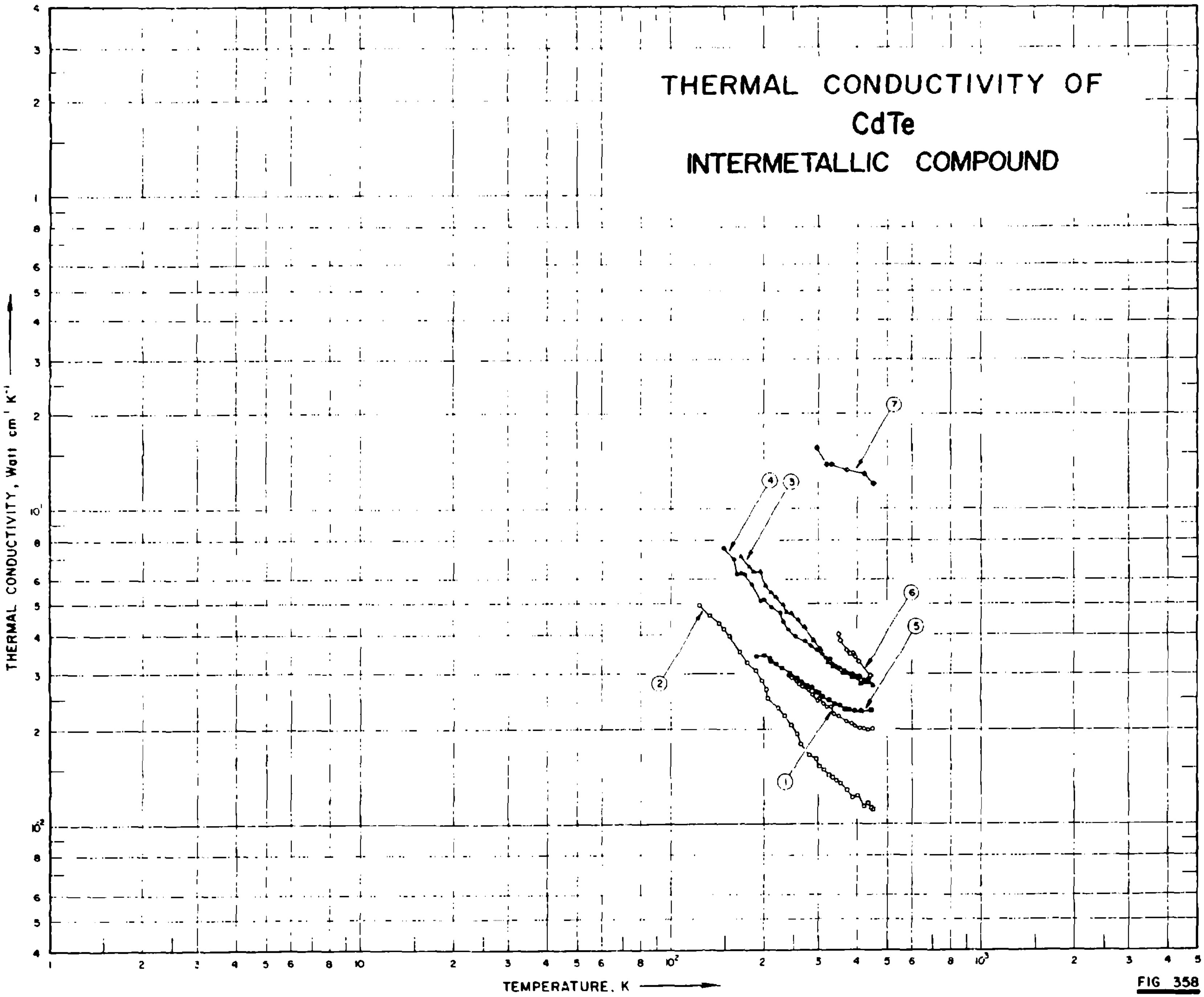

THERMAL CONDUCTIVITY OF
CdTe
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 358

SPECIFICATION TABLE NO. 358 THERMAL CONDUCTIVITY OF CdTe INTERMETALLIC COMPOUNDS

[*For Data Reported in Figure and Table No.* 358]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	942	L	1965	240-449	7	CdTe; 3.2	Stoichiometric single crystal, p-type; prepared by melting 99.999 pure Te and Cd, mixed in a 5 ~ 6 mm dia quartz phial with 1 mm dia x 15 mm long capillary extended at bottom end annealed at 1150 C for 48 hrs; electrical resistivity reported at 228 ~ 485 K was 17.9×10^4 ~ 123 ohm cm; measured in a vacuum of 10^{-4} Torr.
2	942	L	1965	124-451	7	CdTe; 7	Stoichiometric polycrystalline, p-type; same production method and measuring condition as the above specimen, electrical resistivity reported as 589 ~ 479 ohm cm at 134 ~ 485 K.
3	942	L	1965	168-449	7	CdTe; 6	Single crystal, p-type; same production method and measuring condition as the above specimen; electrical resistivity reported as 41.3×10^3 ~ 92.1 ohm cm at 166 ~ 483 K.
4	942	L	1965	148-436	7	CdTe; 9	Similar to the above specimen except electrical resistivity reported as 45.5×10^4 ~ 0.273 x 10^4 ohm cm at 167 ~ 441 K.
5	942	L	1965	189-443	7	CdTe; 8.2	p-type single crystal; same production method and measuring condition as the above specimen; electrical resistivity reported as 1.8×10^4 ~ 337 ohm cm at 190 ~ 444 K.
6	942	L	1965	348-441	7	CdTe; 10.2	Similar to the above specimen except electrical resistivity reported as 42.7×10^4 ~ 1.18 x 10^4 ohm cm at 346 ~ 433 K.
7	94	L	1963	297-450		CdTe	p-type; specimen 8 mm in dia, 12-14 mm long; synthesized in evacuated quartz ampule at 10^{-1} mm Hg, heated to above the melting point of the component with higher melting point for 2 hrs, then heated to the melting point of the compound for 8 hrs; annealed at 700-800 C for several hrs and then cooled to room temperature.

DATA TABLE NO. 358 THERMAL CONDUCTIVITY OF CdTe INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

CURVE 1

T	k
240	0.0297
246	0.0291
248	0.0289*
255	0.0283
260	0.0277
267	0.0272
271	0.0270*
274	0.0272
280	0.0266
288	0.0256
294	0.0254*
298	0.0245
303	0.0249
312	0.0241
320	0.0235
330	0.0235
336	0.0223
342	0.0222*
349	0.0220
359	0.0213*
369	0.0212
383	0.0208
387	0.0204*
394	0.0204
400	0.0204*
407	0.0201
414	0.0201*
420	0.0201
434	0.0199
449	0.0200

CURVE 2

T	k
124	0.0494
134	0.0453
143	0.0434
149	0.0417
155	0.0396
167	0.0354
177	0.0327
186	0.0306
196	0.0284
203	0.0267
207	0.0249
222	0.0234
233	0.0222
245	0.0206
257	0.0193
263	0.0179
280	0.0165
295	0.0160
302	0.0152
313	0.0148
325	0.0144
333	0.0142
343	0.0138
353	0.0135
357	0.0135*
372	0.0128
377	0.0126*
387	0.0122
401	0.0123
421	0.0114
435	0.0117
444	0.0113
451	0.0112

CURVE 3

T	k
168	0.0711
169	0.0733*
174	0.0663
185	0.0638
194	0.0638
202	0.0574
211	0.0546
218	0.0528
232	0.0496
237	0.0471
245	0.0469
258	0.0445
272	0.0423
289	0.0385
303	0.0360
322	0.0327
335	0.0318
359	0.0301
365	0.0300*
369	0.0300*
373	0.0300
378	0.0295*
387	0.0290
395	0.0292
402	0.0289
411	0.0277
418	0.0280
424	0.0277*
430	0.0280
439	0.0280
449	0.0275

CURVE 4

T	k
148	0.0759
160	0.0696
163	0.0623
168	0.0628
174	0.0623
183	0.0578
196	0.0510
200	0.0515
212	0.0486
215	0.0489*
227	0.0469
232	0.0438
241	0.0416
253	0.0395
272	0.0382
284	0.0368
297	0.0359
301	0.0354*
309	0.0347
317	0.0339
323	0.0334
327	0.0326
332	0.0322
339	0.0323*
342	0.0317
351	0.0314
357	0.0310*
364	0.0307
368	0.0307*
386	0.0299
407	0.0295
422	0.0286
435	0.0285

CURVE 5

T	k
189	0.0343
200	0.0343
208	0.0337
210	0.0329
220	0.0323
229	0.0313
243	0.0301
256	0.0289
264	0.0282
276	0.0274
286	0.0270
294	0.0262
301	0.0259
308	0.0254
317	0.0251*
325	0.0247
332	0.0244*
339	0.0241
352	0.0238
357	0.0234*
363	0.0231
372	0.0231*
377	0.0231
383	0.0229*
393	0.0229
411	0.0226
426	0.0225*
443	0.0225

CURVE 6

T	k
348	0.0400
352	0.0384
369	0.0359
378	0.0349
386	0.0351
394	0.0340
405	0.0329
415	0.0328*
441	0.0296

CURVE 7

T	k
297	0.166
318	0.148
330	0.148
369	0.143
424	0.129
450	0.120

* Not shown on plot

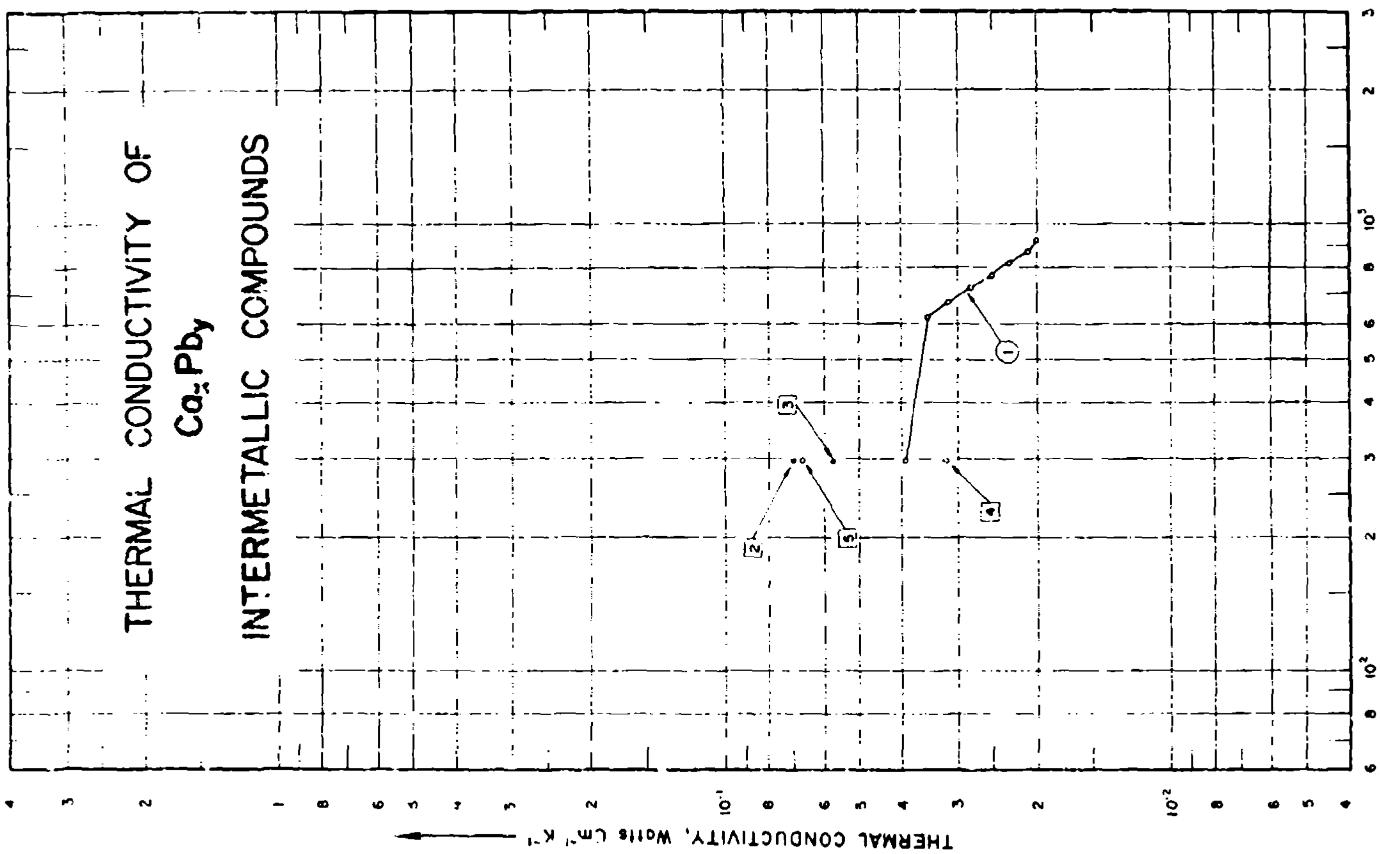

THERMAL CONDUCTIVITY OF
Ca_xPb_y
INTERMETALLIC COMPOUNDS
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 359

SPECIFICATION TABLE NO. 359 THERMAL CONDUCTIVITY OF Ca_xPb_y INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 359]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	548	L	1961	298-923		$Ca_{2.10}Pb$; No. 7	Seebeck coefficient (25C) 177.5 μVK^{-1}; electrical resistivity (25C) 1.17 x 10^{-3} ohm cm; figure of merit (25C) 0.68 x 10^{-3} K^{-1}.
2	548	L	1961	298.2		Ca_2Pb; No. 4	Seebeck coefficient (25C) 102.3 μVK^{-1}; electrical resistivity (25C) 5.75 x 10^{-3} ohm cm; figure of merit (25C) 0.258 x 10^{-4} K^{-1}.
3	548	L	1961	298.2		$Ca_{2.02}Pb$; No. 8	Seebeck coefficient (25C) 228.5 μVK^{-1}; electrical resistivity (25C) 1.24 x 10^{-2} ohm cm; figure of merit (25C) 0.718 x 10^{-4} K^{-1}.
4	548	L	1961	298.2		Ca_2Pb; No. 10	Seebeck coefficient (25C) 109.6 μVK^{-1}; electrical resitivity (25C) 6.53 x 10^{-3} ohm cm; figure of merit (25C) 0.575 x 10^{-4} K^{-1}.
5	548	L	1961	298.2		$Ca_{2.19}Pb$; No. 12	Seebeck coefficient (25C) 84.8 μVK^{-1}; electrical resistivity (25C) 4.28 x 10^{-3} ohm cm; figure of merit (25C) 0.248 x 10^{-4} K^{-1}.

DATA TABLE NO. 359 THERMAL CONDUCTIVITY OF Ca_xPb_y INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
298.2	0.0394
623.2	0.035
673.2	0.0315
723.2	0.028
773.2	0.025
823.2	0.023
873.2	0.021
923.2	0.02
CURVE 2	
298.2	0.0702
CURVE 3	
298.2	0.0573
CURVE 4	
298.2	0.032
CURVE 5	
298.2	0.0677

SPECIFICATION TABLE NO. 360 THERMAL CONDUCTIVITY OF Ca_2Sn INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	548	L	1961	298.2		Ca_2Sn No. 9	Synthesized; seebeck coeff. 37 $\mu v K^{-1}$ at 25 C; electrical resistivity 4.61 x 10^{-2} ohm cm at 25 C; figure of merit 0.742 x 10^{-5} K^{-1} at 25 C.
2	548	L	1961	298.2		Ca_2Sn No. 12	Synthesized; seebeck coeff. 17.4 $\mu v K^{-1}$ at 25 C; electrical resistivity 4.29 x 10^{-4} ohm cm at 25 C; figure of merit 0.280 x 10^{-4} K^{-1} at 25 C.
3	548	L	1961	298.2		Ca_2Sn No. 13	Synthesized; seebeck coeff. 17.7 $\mu v K^{-1}$ at 25 C; electrical resistivity 8.88 x 10^{-4} ohm cm at 25 C; figure of merit 0.114 x 10^{-4} K^{-1} at 25 C.

DATA TABLE NO. 360 THERMAL CONDUCTIVITY OF Ca_2Sn INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.00256
CURVE 2*	
298.2	0.0403
CURVE 3*	
298.2	0.0308

* No graphical presentation

SPECIFICATION TABLE NO. 361 THERMAL CONDUCTIVITY OF CoSi INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	549	L	1959	326.2	± 10	CoSi	Single crystal; supplied by Transitron Electronics.

DATA TABLE NO. 361 THERMAL CONDUCTIVITY OF CoSi INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
326.2	0.097

* No graphical presentation

SPECIFICATION TABLE NO. 362 THERMAL CONDUCTIVITY OF $CuSbSe_2$ INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	944		1962	298.2		$CuSbSe_2$	p-type; specimen obtained by fusing ASARCO 99.999 pure elements in carbon-coated quartz tube with agitation, cooling, crushing, recasting in 8 mm uncoated quartz, and zone-leveling; electrical resistivity 1.2 - 1.8 ohm cm; melting point (with decomposition) 485 K, (measuring temperature assumed 25 C).

DATA TABLE NO. 362 THERMAL CONDUCTIVITY OF $CuSbSe_2$ INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.0170

* No graphical presentation

SPECIFICATION TABLE NO. 363 THERMAL CONDUCTIVITY OF Cu_3Se_2 INTERMETALLIC COMPOUNDS

Curve No.	Ref. No	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	944		1962	298.2		Cu_3Se_2	p-type; specimen obtained by fusing ASARCO 99.999 pure elements in carbon-coated 15 mm outside dia quartz tube with agitation, cooling, crushing, recasting in 8 mm uncoated quartz, and zone-leveling; electrical resistivity 0.1 milliohm cm; melting point 355 K (decomposition), (measuring temperature assumed 25 C).

DATA TABLE NO. 363 THERMAL CONDUCTIVITY OF Cu_3Se_2 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.0240

* No graphical presentation

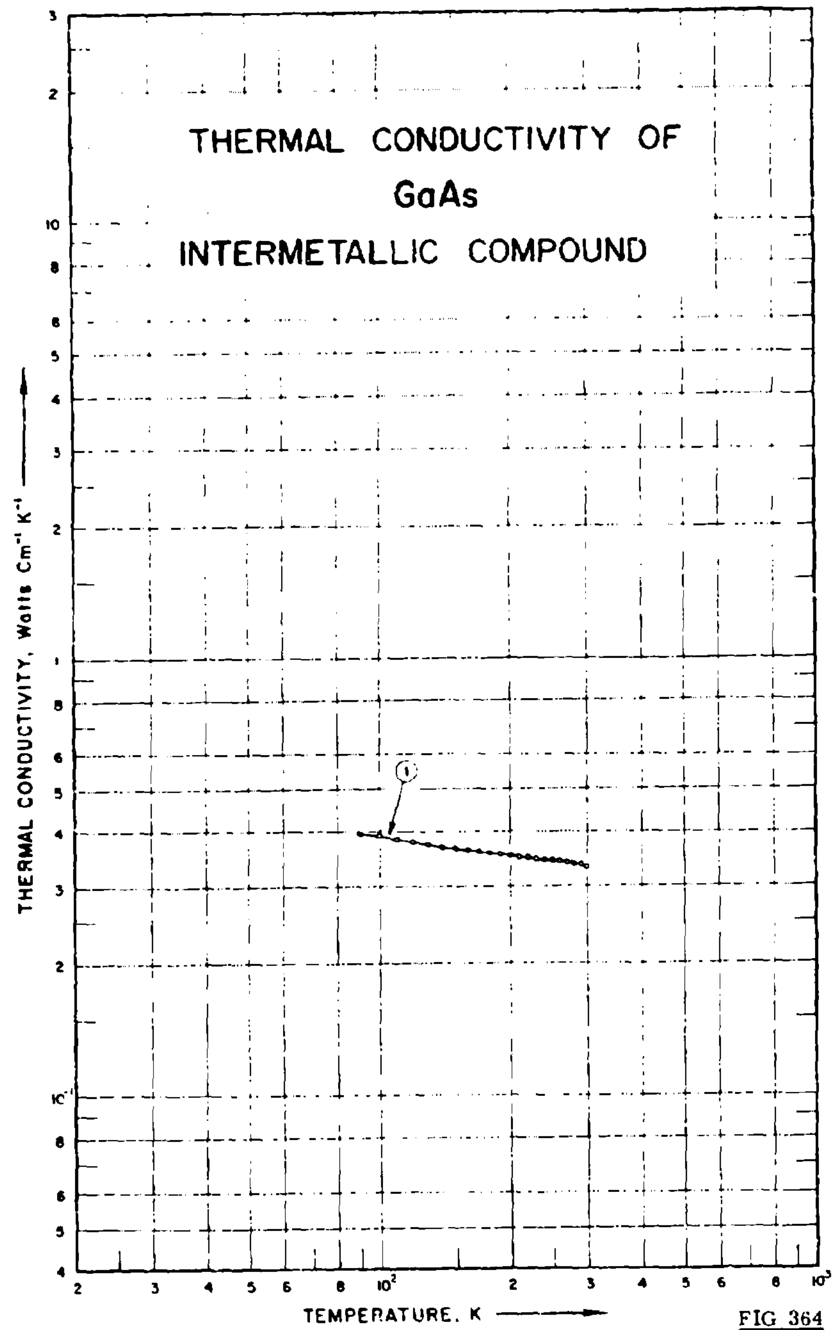

THERMAL CONDUCTIVITY OF
GaAs
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}
TEMPERATURE, K
1

FIG 364

SPECIFICATION TABLE NO. 364 THERMAL CONDUCTIVITY OF GaAs INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 364]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	519	L	1958	90-300	2-3	GaAs	Impurities of the order of 0.0001%; p-type polycrystalline specimen ~5 mm in dia; current concentration of the order of 10^{18} cm^{-3}.

DATA TABLE NO. 364 THERMAL CONDUCTIVITY OF GaAs INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
90	0.397
100	0.391
110	0.38[illegible]
120	0.37[illegible]
130	0.372
140	0.368
150	0.364
160	0.361
170	0.358
180	0.356
190	0.353
200	0.351
210	0.349
220	0.346
230	0.344
240	0.343
250	0.341
260	0.340
270	0.337
280	0.336
290	0.335
300	0.330

SPECIFICATION TABLE NO. 365 THERMAL CONDUCTIVITY OF GeTe INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	947	L	1960	300		GeTe	Pure; electrical resistivity 1.43×10^{-4} ohm cm.
2	948		1961	300		GeTe	Specimen 6 mm in dia and 4 mm thick; prepared from semi-conducting grade Ge (electrical resistivity 40 ohm cm) supplied by Eagle Pichard Co. and semi-conducting grade Te supplied by American Smelting and Refining Co.; electrical resistivity 1.39 μ ohm cm at 300 K.

DATA TABLE NO. 365 THERMAL CONDUCTIVITY OF GeTe INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
300	0.0687
CURVE 2*	
300	0.069

* No graphical presentation

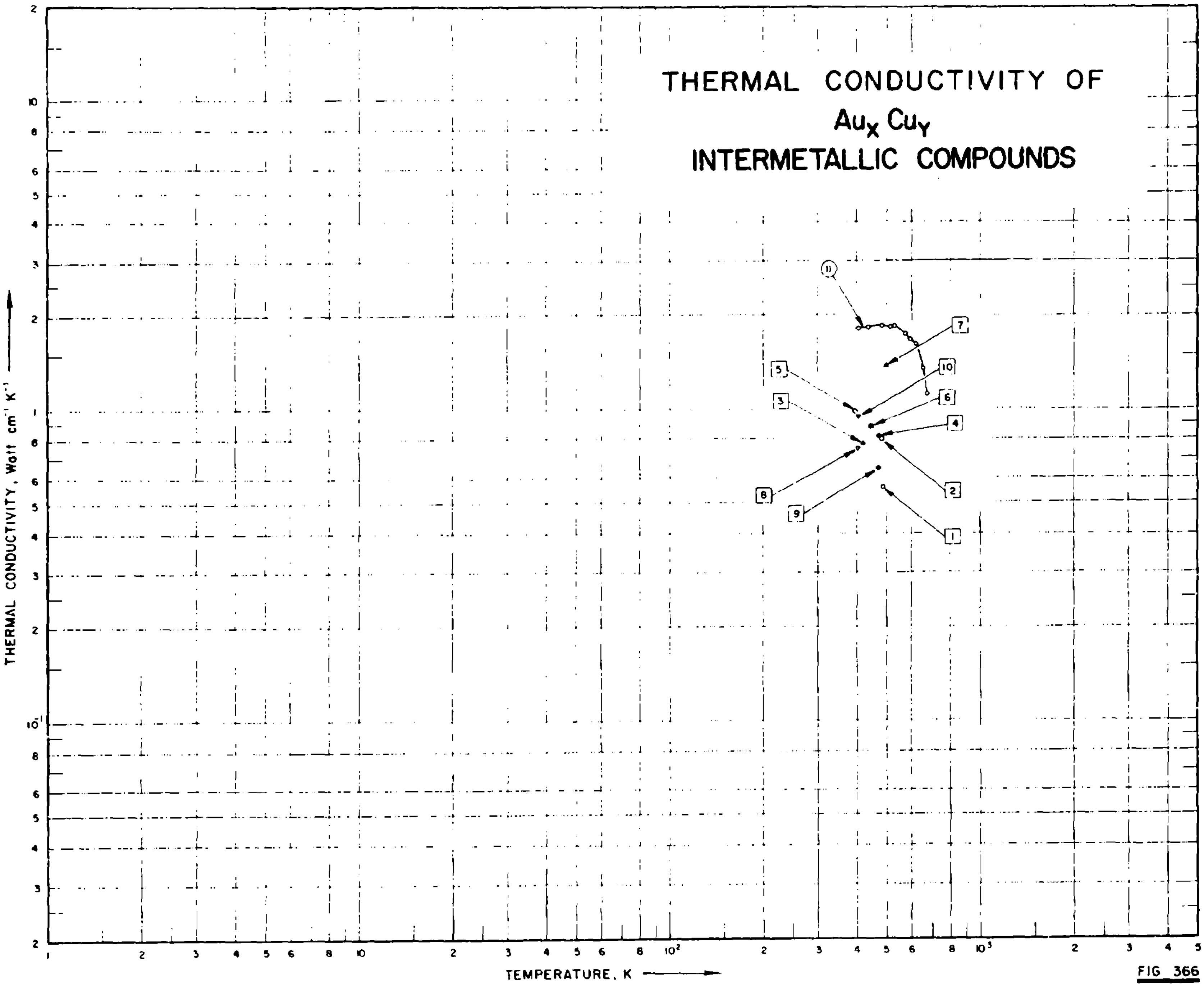

THERMAL CONDUCTIVITY OF
$Au_X Cu_Y$
INTERMETALLIC COMPOUNDS
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
1
2
3
4
5
6
7
8
9
10
11

FIG 366

SPECIFICATION TABLE NO. 366 THERMAL CONDUCTIVITY OF Au_xCu_y INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 366]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	232	L	1957	488.7		CuAu;IV	Cast; 1.30 cm long; 0.63 cm^2 cross sectional area; density 18.34 g cm^{-3}.
2	232	L	1957	483.2		CuAu;IV	The above specimen annealed for 10 hr at 200 C.
3	232	L	1957	420.7		CuAu;IV	The above specimen annealed for 20 hr at 200 C.
4	232	L	1957	473.7		CuAu;IV	The above specimen annealed for 30 hr at 200 C.
5	232	L	1957	395.2		CuAu;IV	The above specimen annealed for 40 hr at 200 C.
6	232	L	1957	445.7		Cu_3Au;II	Cast; 1.49 cm long, 0.63 cm^2 cross sectional area; density 15.05 g cm^{-3}.
7	232	L	1957	493.2		Cu_3Au;II	The above specimen annealed for 10 hr at 200 C.
8	232	L	1957	401.7		Cu_3Au;II	The above specimen annealed for 20 hr at 200 C.
9	232	L	1957	470.2		Cu_3Au;II	The above specimen annealed for 30 hr at 200 C.
10	232	L	1957	403.7		Cu_3Au;II	The above specimen annealed for 40 hr at 200 C.
11	477	L	1962	407-680		Cu_3Au	0.1858 in. dia x 2.41 in. long; successively annealed at 360 C for 90 hrs, 240 C for 110 hrs, and 220 C for 600 hrs; critical temperature lies between 387.5 and 388.2 C; electrical resistivity reported as 4.2582, 4.3864, 4.8367, 5.2834, 5.6889, 6.2509, 6.6710, 7.2362, 8.2142, 9.3038, 10.6252, 10.8993, 11.3171, 12.1987, 13.6671, 14.0257, 14.0335, 14.0752, 14.1084 and 14.2959 µohm at 33.30, 43.74, 83.38, 124.04, 160.92, 211.71, 248.80, 278.71, 311.98, 345.78, 373.61, 377.93, 382.60, 385.80, 387.54, 388.19, 390.97, 395.25, 404.20, and 419.77 C respectively (selected from 76 points reported by the authors).

DATA TABLE NO. 366 THERMAL CONDUCTIVITY OF Au_xCu_y INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k	T	k
CURVE 1		CURVE 11 (cont.)	
488.7	0.561	437.4	1.849
		445.7	1.854*
CURVE 2		455.3	1.858*
		467.1	1.854*
483.2	0.803	473.5	1.858*
		482.0	1.854
CURVE 3		490.3	1.862*
		497.2	1.858*
420.7	0.774	506.3	1.849*
		512.1	1.841*
CURVE 4		512.2	1.845
		514.1	1.845*
473.7	0.816	520.5	1.858*
		520.6	1.862*
CURVE 5		523.5	1.845*
		530.1	1.854
395.2	0.9[illegible]	538.2	1.849*
		547.2	1.841*
CURVE 6		555.7	1.820*
		564.0	1.778*
445.7	0.879	572.5	1.753
		572.7	1.753*
CURVE 7		580.6	1.732*
		588.1	1.707*
493.2	1.339	588.4	1.695*
		595.5	1.699
CURVE 8		603.3	1.665*
		609.3	1.657*
401.7	0.745	608.7	1.657*
		614.0	1.648*
CURVE 9		621.2	1.632
		629.4	1.602*
470.2	0.649	637.0	1.582*
		644.0	1.523*
CURVE 10		651.0	1.431*
		655.3	1.356
403.7	0.946	662.6	1.121*
		664.1	1.121*
CURVE 11		670.2	1.121*
		672.2	1.121*
406.8	1.833	674.4	1.123
414.5	1.841*	679.3	1.134*
414.7	1.833*		
420.8	1.841*		
430.9	1.841*		

* Not shown on plot

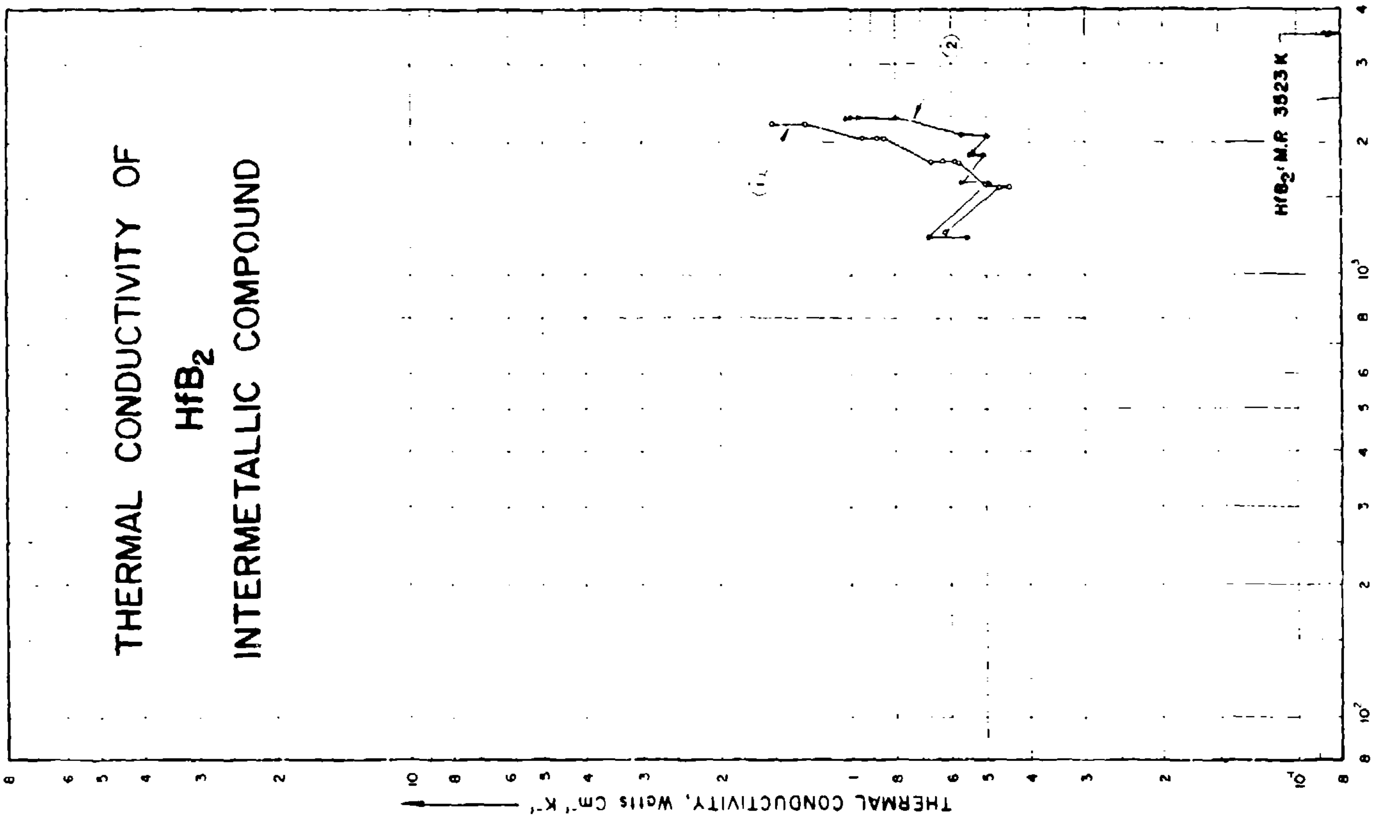

THERMAL CONDUCTIVITY OF
HfB2
INTERMETALLIC COMPOUND
HfB2: M.P. 3523 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts cm⁻¹ K⁻¹

FIG 367

SPECIFICATION TABLE NO. 367 THERMAL CONDUCTIVITY OF HfB_2 INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 367]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	544	R	1963	1267-2210	5-7.0	HfB_2; 1	Specimen 0.75 in. O.D. and 0.25 in. I.D., 0.75 in. long; heat soaked at 3200 F to 3350 F; ground and polished; specimen found cracked on post inspection.
2	544	R	1963	1233-2297	5-7.0	HfB_2; 2	Similar to the above specimen but the specimen broke during experiment.

DATA TABLE NO. 367 THERMAL CONDUCTIVITY OF HfB_2 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
1266.5	0.621
1266.5	0.617*
1266.5	0.624*
1592.1	0.467
1595.4	0.443
1599.3	0.501
1803.7	0.574
1805.4	0.585
1807.6	0.628
1808.7	0.666
2055.4	0.845
2055.9	0.874
2058.7	0.941
2205.4	1.27
2206.5	1.28*
2210.4	1.52
CURVE 2	
1233.2	0.550
1233.2	0.555*
1233.2	0.675
1624.3	0.492
1631.5	0.500*
1637.6	0.568
1880.9	0.502
1881.5	0.545
1882.6	0.535
2082.1	0.495
2087.1	0.562
2087.9	0.555*
2285.9	0.794
2294.3	0.956
2296.5	1.00
2297.1	1.02

* Not shown on plot

FIGURE SHOWS ONLY 19 OF THE CURVES REPORTED IN TABLE

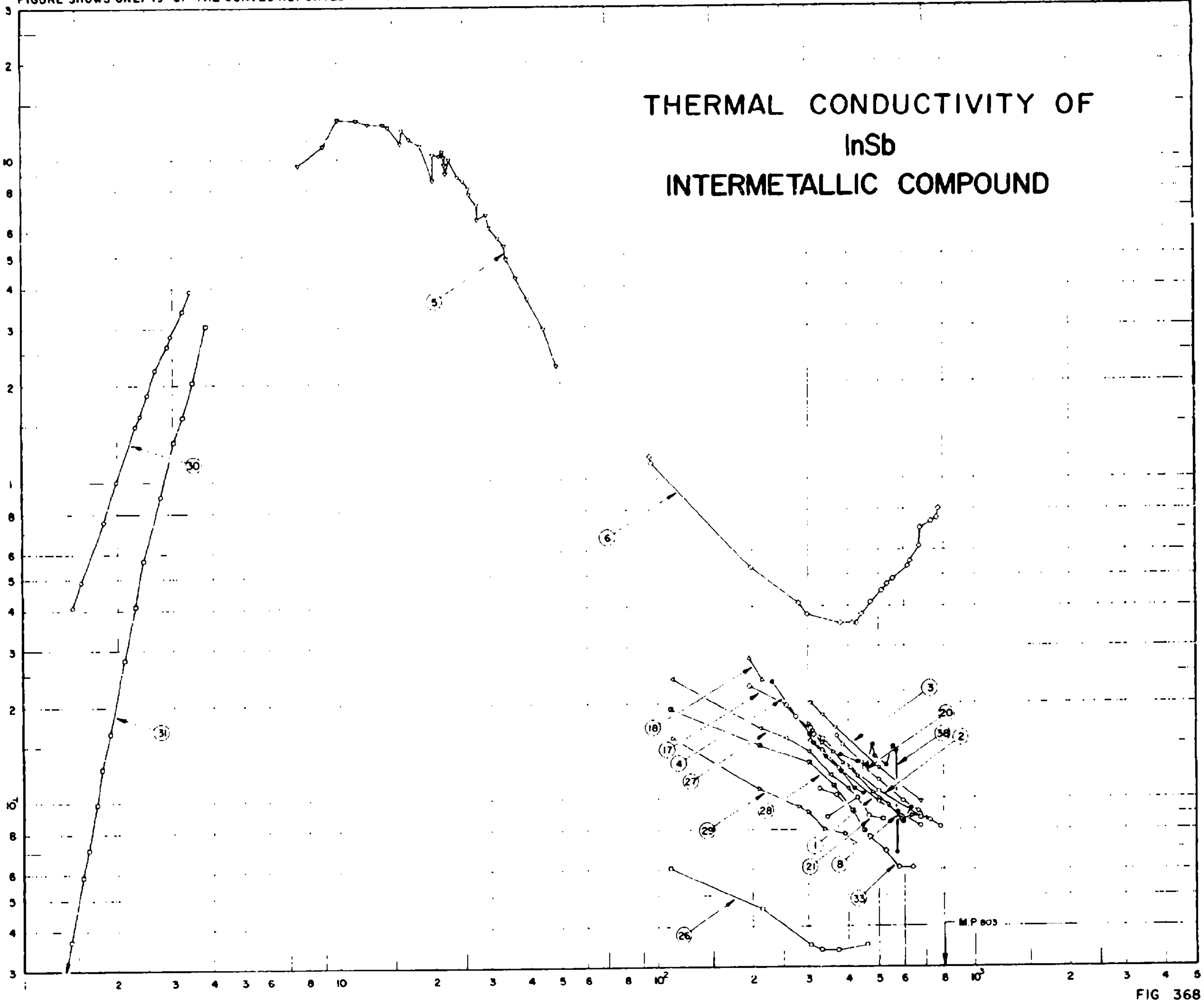


FIG 368

SPECIFICATION TABLE NO. 368 THERMAL CONDUCTIVITY OF InSb INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 368]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	309	C	1957	305-678	±10	InSb; A	p-type indium antimonide; single crystal; 2 x 10^{15} extrinsic electrons cm^{-3}, weakly degenerate over the temperature range; Firth Brown F.H. steel used as reference material.
2	309	C	1957	305-678	±10	InSb; B	n-type, single crystal; 10^{17} extrinsic electrons cm^{-3}, weakly degenerate over the temperature range; Firth Brown F.H. steel used as reference material.
3	309	C	1957	305-678	±10	InSb; C	n-type, single crystal, 2 x 10^{18} extrinsic electrons cm^{-3}, strongly degenerate near room temperature; Firth Brown F.H. steel used as reference material.
4	307	P	1959	232-446		InSb	Single crystal; 3 x 10^{17} electrons cm^{-3}, specific heat 12 cal mol^{-1}.
5	303	L	1959	7.5-49		InSb	p-type single crystal; impurity concentration 2.89 x 10^{17} cm^{-3} (from thermal conductivity data); electrical conductivity 14.1 ohm^{-1} cm^{-1} at 78 K.
6	302		1954	95-773		InSb	No details reported.
7			1958	330-770		InSb	No details reported.
8	590	P	1960	300-715		InSb; IS-194	Single crystal; rectangular parallepiped dimensions 1 1/2 x 3/8 x 3/8 in.
9	542	C	1962	308-443	±20	InSb; E-1	n-type single crystal; donor concentration 10^{16} cm^{-3}; specimen 12.3 mm dia, 7.2 mm long; measured in vacuo of 5 x 10^{-5} mm Hg.
10	542	C	1962	445-573	±20	InSb; S-1	Similar to the above specimen.
11	542	C	1962	406-575	±20	InSb; S-1	The above specimen measured in a magnetic field of 1000 gauss.
12	542	C	1962	406-575	±20	InSb; S-1	The above specimen measured in a magnetic field of 2000 gauss.
13	542	C	1962	406-575	±20	InSb; S-1	The above specimen measured in a magnetic field of 3000 gauss.
14	542	C	1962	406-575	±20	InSb; S-1	The above specimen measured in a magnetic field of 5000 gauss.
15	542	C	1962	448-575	±20	InSb; S-1	The above specimen measured in a magnetic field of 7000 gauss.
16	542	C	1962	406-575	±20	InSb; S-1	The above specimen measured in a magnetic field of 8000 gauss.
17	611	L	1959	196-667	± 4	InSb; We	p-type single crystal; dislocation concentration 1.6 x 10^{15} cm^{-3}, measured in vacuo of ~ 5 x 10^{-5} torr.
18	611	L	1959	196-667	± 4	InSb; Wd	n-type single crystal; dislocation concentration 1.2 x 10^{16} cm^{-3}, measured in vacuo of ~ 5 x 10^{-5} torr.
19	611	L	1959	339-526	± 4	InSb; Wb	p-type single crystal; dislocation concentration 3.3 x 10^{15} cm^{-3}, measured in vacuo of ~ 5 x 10^{-5} torr.
20	825		1958	368-781		InSb	No details reported.

SPECIFICATION TABLE NO. 368 THERMAL CONDUCTIVITY OF InSb INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 368]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
21	949	E	1965	345-518	12	InSb	n-type single crystal; donor concentration 5×10^{16} cm^{-3}; specimen 2.51 cm in dia and 0.27 cm thick; measured in vacuum of $\geq 5 \times 10^{-5}$ torr; measured in a magnetic field of zero gauss.
22	949	E	1965	345-518	12	InSb	The above specimen measured in a magnetic field of 1000 gauss.
23	949	E	1965	345-518	12	InSb	The above specimen measured in a magnetic field of 2000 gauss.
24	949	E	1965	345-518	12	InSb	The above specimen measured in a magnetic field of 5000 gauss.
25	949	E	1965	345-518	12	InSb	The above specimen measured in a magnetic field of 8000 gauss.
26	950, 951	L	1963	110-459		InSb	Large crystals; prepared from highly pure indium and Sb-000 antimony purified by multiple-zone recrystallization, synthesized in evacuated (10^{-3} mm Hg) quartz ampoule, slowly cooled; carrier concentration 10^{16} cm^{-3}.
27	950, 951	L	1963	113-459		InSb	0.26 In_2Te_3; prepared from highly pure indium, Sb-000 antimony, and tellurium purified by multiple-zone recrystallization, synthesized in evacuated (10^{-3} mm Hg) quartz ampoule, slowly cooled.
28	950, 951	L	1963	111-452		InSb	0.77 In_2Te_3; same fabrication method as the above specimen.
29	950, 951	L	1963	112-419		InSb	1.28 In_2Te_3; same fabrication method as the above specimen.
30	952	L	1962	1.5-3.4	± 2	InSb;N	Tellurium added as impurity; n-type; carrier concentration reported at 77 K as 1.4×10^{17} carriers per cm^3; specimen 1.8 x 3.95 mm in. cross-section; cut from single crystals with axis normal to direction of growth; sandblasted.
31	952	L	1962	1.4-3.8	± 2	InSb;P	Germanium added as impurity; p-type; hole concentration reported at 77K as 2×10^{16} holes per cm^3; specimen 2.3 x 3.55 mm in. cross-section; cut from single crystal with axis normal to direction of growth; sandblasted.
32	953	C	1965	327, 416		InSb;E-2	5×10^{19} Zr and 5×10^{19} Cd impurity atoms per cm^3; p-type; single crystal; specimen 12 mm in. dia and 7 mm -12 mm high; supplied by Exotic Materials Inc.; first set.
33	953	C	1965	325-640		InSb;E-2	Similar to the above specimen; second set.
34	953	C	1965	328-633		InSb;S-5	Similar to the above specimen except for 2×10^{18} Zr impurity atoms per cm^3; first set.
35	953	C	1965	325-494		InSb;S-5	Similar to the above specimen; second set.
36	953	C	1965	323-634		InSb,S-4A	Similar to the above specimen except for 1.3×10^{18} Zr impurity atoms per cm^3; first set.
37	953	C	1965	325-635		InSb,S-4A	Similar to the above specimen; second set.
38	953	C	1965	379-631		InSb,S-1	3.32×10^{18} Te impurity atoms per cm^3; n-type; single crystal; specimen 12 mm in. dia and 7 mm - 12 mm high; supplied by Merk and Co., Rahway, New Jersey; run 1.
39	953	C	1965	338-600		InSb,S-1	Similar to the above specimen; run 2.

DATA TABLE NO. 368 THERMAL CONDUCTIVITY OF InSb INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
305	0.153
333	0.142
375	0.126
500	0.0975
678	0.0820
CURVE 2	
305	0.167
333	0.155
407	0.126
500	0.106
678	0.087
CURVE 3	
305	0.201
333	0.184
365	0.167
500	0.126
678	0.0975
CURVE 4	
231.8	0.233
303.4	0.159
313.0	0.149
341.9	0.136
381.8	0.123
420.3	0.108
446.0	0.104
CURVE 5	
7.5	9.52
9.0	10.99
10.0	13.3
11.5	13.2
12.5	12.8
14.0	12.7
14.5	12.5
15.8	11.1
16.0	12.2
16.9	11.5
CURVE 5 (cont.)	
18.3	10.99
20.0	8.47
20.0	10.3
21.0	10.2
21.5	10.6
21.7	10.1
21.7	9.52
21.8	8.93
22.5	9.90
24.0	8.70
25.0	8.47
25.9	8.00
26.0	7.69
27.5	7.14
27.5	6.45
29.5	6.67
30.0	6.06
32.0	5.62
33.5	5.32
34.0	4.85
36.5	4.24
39.5	3.64
44.5	2.94
48.5	2.24
CURVE 6	
95.2	1.17
96.2	1.12
198.2	0.527
279.2	0.410
298.2	0.377
378.2	0.356
415.2	0.356
426.2	0.356
443.2	0.377
473.2	0.410
513.2	0.444
533.2	0.469
555.2	0.485
619.2	0.531
628.2	0.552
671.2	0.619
675.2	0.703
CURVE 6 (cont.)	
733.2	0.736
761.2	0.753
773.2	0.803
CURVE 7	
330	0.150
400	0.130
500	0.106
670	0.086
770	0.075
CURVE 8	
300	0.172
330	0.154*
330	0.149
348	0.150*
360	0.141
385	0.130
413	0.120*
427	0.118
477	0.105
500	0.100
535	0.0952
590	0.0856
635	0.0880
680	0.0830*
715	0.0864
CURVE 9*	
308	0.148
406	0.122
443	0.108
CURVE 10*	
445	0.110
473	0.0943
573	0.0912
CURVE 11*	
406	0.122
473	0.0931
575	0.0907
CURVE 12*	
406	0.121
473	0.0922
575	0.0903
CURVE 13*	
406	0.120
448	0.106
473	0.0913
575	0.0887
CURVE 14	
406	0.118*
448	0.105*
473	0.0891
575	0.0863
CURVE 15*	
448	0.103
473	0.0879
575	0.0843
CURVE 16*	
406	0.117
448	0.103
473	0.0873
575	0.0832
CURVE 17	
196.1	0.266
256.4	0.197
274.0	0.182
312.5	0.159
344.8	0.144*
CURVE 17 (cont.)	
370.4	0.133*
400.0	0.126*
425.5	0.118*
454.5	0.110*
476.2	0.109*
512.8	0.100
555.6	0.0920*
588.2	0.0900*
625.0	0.0879*
666.7	0.0837*
CURVE 18	
196.1	0.276
215.1	0.236
588.2	0.0920*
666.7	0.0900*
CURVE 19*	
339.0	0.149
350.9	0.142
408.2	0.121
454.5	0.109
512.8	0.105
526.3	0.0983
CURVE 20	
368	0.158
335	0.148
442	0.130
450	0.125
500	0.115
595	0.098
667	0.091
725	0.085
781	0.081
CURVE 21	
345.2	0.087
428.2	0.100
468.2	0.088
518.2	0.086
CURVE 22*	
345.2	0.0867
428.2	0.0992
468.2	0.0871
518.2	0.0849
CURVE 23*	
345.2	0.0863
428.2	0.0999
468.2	0.0870
518.2	0.0850
CURVE 24*	
345.2	0.0866
428.2	0.0984
468.2	0.0864
518.2	0.0836
CURVE 25*	
345.2	0.0863
428.2	0.0977
468.2	0.0954
518.2	0.0827
CURVE 26	
110	0.0610
214	0.0455
305	0.0353
330	0.0340
373	0.0339
459	0.0353
CURVE 27	
113	0.238
212	0.167
258	0.156
302	0.141
355	0.119
403	0.108
433	0.0943*
459	0.0877*
CURVE 28	
111	0.192
211	0.147
303	0.130
361	0.110
417	0.0909
452	0.0794
CURVE 29	
112	0.156
211	0.108
280	0.0943
301	0.0901
338	0.0800
392	0.0775
419	0.0725
CURVE 30	
1.45	0.4102
1.55	0.4943
1.82	0.7586
1.98	1.009
2.30	1.496
2.37	1.603
2.50	1.866
2.65	2.239
2.89	2.636
2.97	2.831
3.25	3.412
3.43	3.908

* Not shown on plot

DATA TABLE NO. 368 (continued)

CURVE 31

T	k
1.35	0.0280*
1.43	0.0375
1.56	0.0594
1.62	0.0716
1.73	0.0988
1.79	0.1282
1.90	0.1652
2.11	0.2799
2.28	0.4130
2.43	0.5702
2.75	0.8974
3.02	1.337
3.22	1.589
3.42	2.042
3.84	3.048

CURVE 32*

T	k
327	0.1029
416	0.0912

CURVE 33

T	k
325	0.1084
368	0.1032
412	0.0910*
472	0.0753
527	0.0685
581	0.0607
640	0.0607

CURVE 34*

T	k
328	0.1119
371	0.1182
412	0.1001
455	0.0863
492	0.0771
532	0.0686
571	0.0620
633	0.0495

CURVE 35*

T	k
325	0.1400
375	0.1331
419	0.1089
455	0.0994
494	0.0907

CURVE 36*

T	k
323	0.1241
375	0.1235
413	0.1127
454	0.1054
488	0.0982
538	0.0904
582	0.0839
634	0.0778

CURVE 37*

T	k
325	0.1358
375	0.1209
453	0.0923
535	0.0767
635	0.0642

CURVE 38

T	k
379	0.137
427	0.131
457	0.128
476	0.147
486	0.136
529	0.127
551	0.146
568	0.141
574	0.068
575	0.090
599	0.084
631	0.093

CURVE 39*

T	k
338	0.135
380	0.118
416	0.105
450	0.104
479	0.103
514	0.102
545	0.104
575	0.101
600	0.095

* Not shown on plot

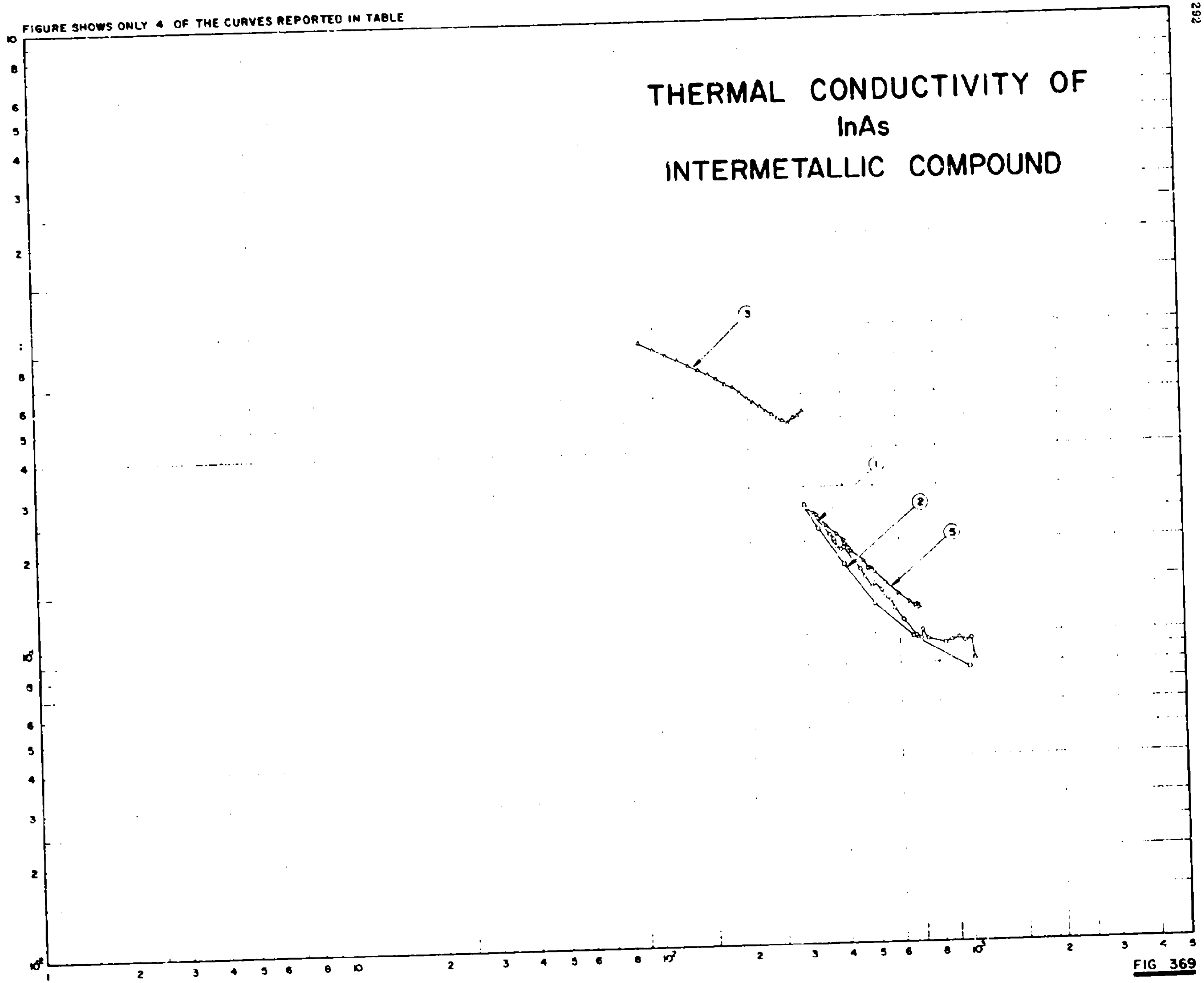


FIGURE SHOWS ONLY 4 OF THE CURVES REPORTED IN TABLE
THERMAL CONDUCTIVITY OF
InAs
INTERMETALLIC COMPOUND
1
2
3
5

FIG 369

SPECIFICATION TABLE NO. 369 THERMAL CONDUCTIVITY OF InAs INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 369]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	300	C	1958	301-1054	10	InAs	n-type; polycrystal; doped with extrinsic carriers of $\sim10^{18}$ cm^{-3}; the doping agent (sulphur) added in the form of an In + S alloy; high grade dense alumina (calibrated against Armco iron) used as the comparative material; data obtained from two specimens of the same specifications.
2	300	C	1958	302-1000	10	InAs	Similar to the above specimens but doped with 5 x 10^{16} extrinsic carriers.
3	519	L	1958	90-300	2-3	InAs	p-type; concentration of current carriers of the order of 10^{18} cm^{-3}; specimen ~5 mm in dia; synthesized from original materials in double evacuated quartz ampules, re-melted to obtain the right form with heating rate of 100 C per hr; purified by zone melting (impurity ~0.0001%).
4	578	C	1960	309-691	± 5	Indium Arsenide	Pure; polycrystal; electron concentration ~3 x 10^{16} cm^{-3}; F.H. stainless steel (checked by Armco iron) used as comparative material; data from three specimens.
5	578	C	1960	308-693	± 5	Indium Arsenide	Similar to the above specimens but sulphur doped to give an electron concentration of $\sim10^{19}$ cm^{-3}.

DATA TABLE NO. 369 THERMAL CONDUCTIVITY OF InAs INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
301.2	0.264
362.3	0.209
373.1	0.202
375.9	0.198
380.2	0.192
392.2	0.188
400.0	0.190
452.5	0.162
469.5	0.153
492.6	0.140
500.0	0.145
526.3	0.137
537.6	0.131
565.0	0.127
578.0	0.121
619.6	0.111
680.3	0.0980
704.2	0.0960
714.3	0.102
740.7	0.0950
840.3	0.0923
885.0	0.0843
934.6	0.0860
970.9	0.0835
1007.0	0.0855
1053.7	0.0820
CURVE 2	
302	0.257
333	0.219
400	0.167
500	0.125
667	0.098
1000	0.077
CURVE 3	
90	0.904
100	0.858
110	0.816
120	0.787
130	0.753
140	0.728
CURVE 3 (cont.)	
150	0.703
160	0.678
170	0.653
180	0.636
190	0.611
200	0.586
210	0.569
220	0.552
230	0.531
240	0.519
250	0.502
260	0.494
270	0.485
280	0.502
290	0.510
300	0.531
CURVE 4*	
309.2	0.256
331.2	0.236
335.2	0.231
339.2	0.234
400.2	0.187
403.2	0.184
453.2	0.160
493.2	0.143
505.2	0.131
597.2	0.114
678.2	0.107
691.2	0.102
CURVE 5	
308.2	0.254*
318.2	0.246*
320.2	0.248
328.2	0.244
353.2	0.224
379.2	0.211
400.2	0.201
403.2	0.195
416.2	0.188
421.2	0.185
CURVE 5 (cont.)	
464.2	0.172
479.2	0.163
498.2	0.163
502.2	0.158
544.2	0.146
596.2	0.134
647.2	0.126
676.2	0.123
686.2	0.123
693.2	0.121

* Not shown on plot

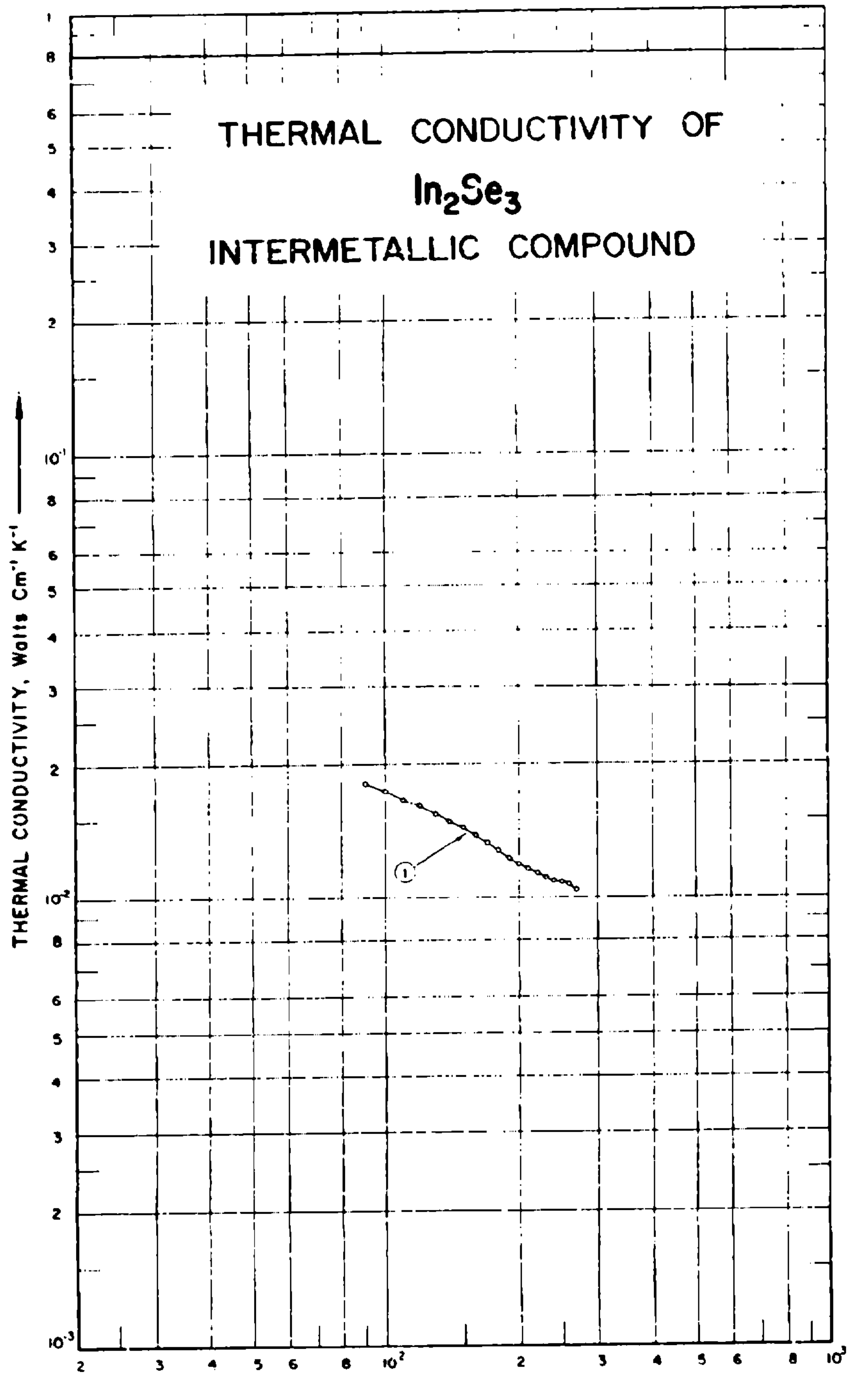

THERMAL CONDUCTIVITY OF
In2Se3
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watts Cm-1 K-1
TEMPERATURE, K
1

FIG 370

SPECIFICATION TABLE NO. 370 THERMAL CONDUCTIVITY OF In_2Se_3 INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 370]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	519		1958	90-270	~2.5	In_2Se_3	Polycrystal; specimen ~5.5 mm dia; prepared by zone melting from pure Se and In.

DATA TABLE NO. 370 THERMAL CONDUCTIVITY OF In_2Se_3 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
90	0.0182
100	0.0175
110	0.0167
120	0.0162
130	0.0155
140	0.0149
150	0.0144
160	0.0138
170	0.0133
180	0.0128
190	0.0123
200	0.0120
210	0.0117
220	0.0115
230	0.0112
240	0.0110
250	0.0109
260	0.0108
270	0.0105

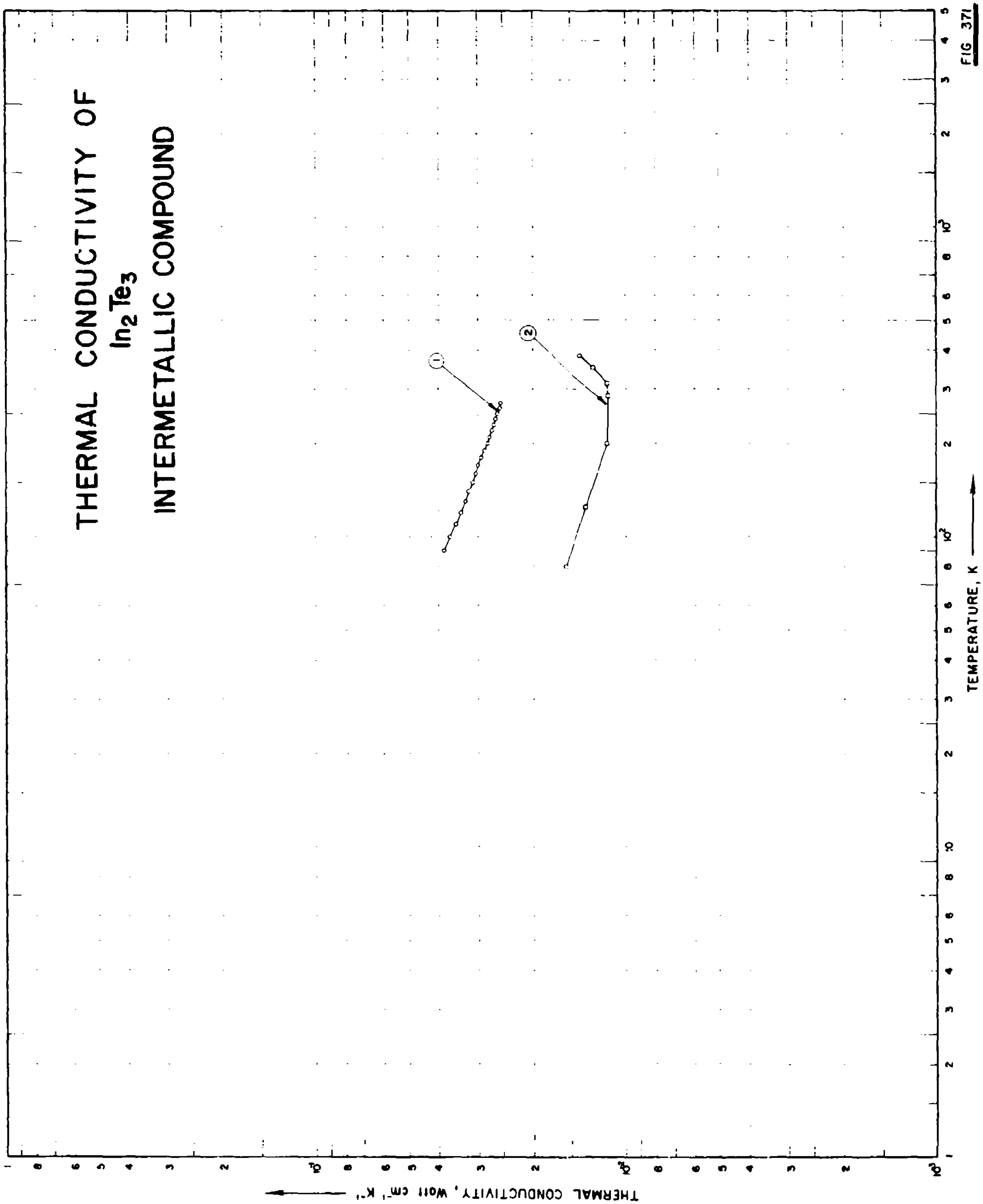

THERMAL CONDUCTIVITY OF
In_2Te_3
INTERMETALLIC COMPOUND
1
2
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 371

SPECIFICATION TABLE NO. 371 THERMAL CONDUCTIVITY OF In_2Te_3 INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 371]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	519		1958	90-270	2-3	In_2Te_3	Polycrystal; zone purified 10^{-4} carriers cm^{-3}; specimen ~5.5 mm dia.
2	825		1958	80-385		In_2Te_3	Zone refined.

DATA TABLE NO. 371 THERMAL CONDUCTIVITY OF In_2Te_3 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
90	0.0385
100	0.0368
110	0.0351
120	0.0339
130	0.0328
140	0.0320
150	0.0312
160	0.0305
170	0.0299
180	0.0293
190	0.0286
200	0.0280
210	0.0276
220	0.0271
230	0.0267
240	0.0264
250	0.0260
260	0.0256
270	0.0254
CURVE 2	
80	0.0155
125	0.0135
200	0.0116
286	0.0115
313	0.0116
351	0.0127
385	0.0140

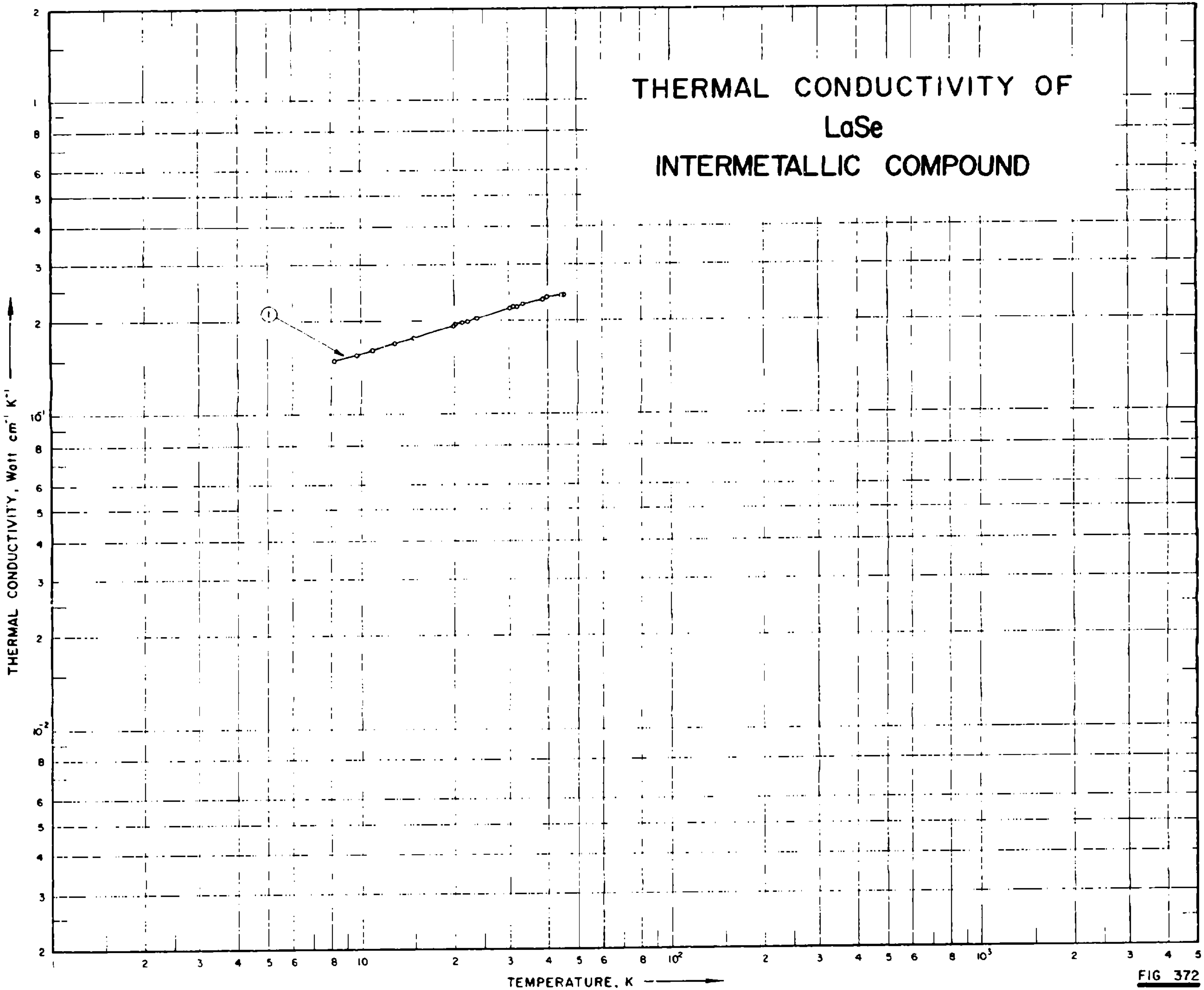

THERMAL CONDUCTIVITY OF
LaSe
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1

FIG 372

SPECIFICATION TABLE NO. 372 THERMAL CONDUCTIVITY OF LaSe INTERMETALLIC COMPOUNDS

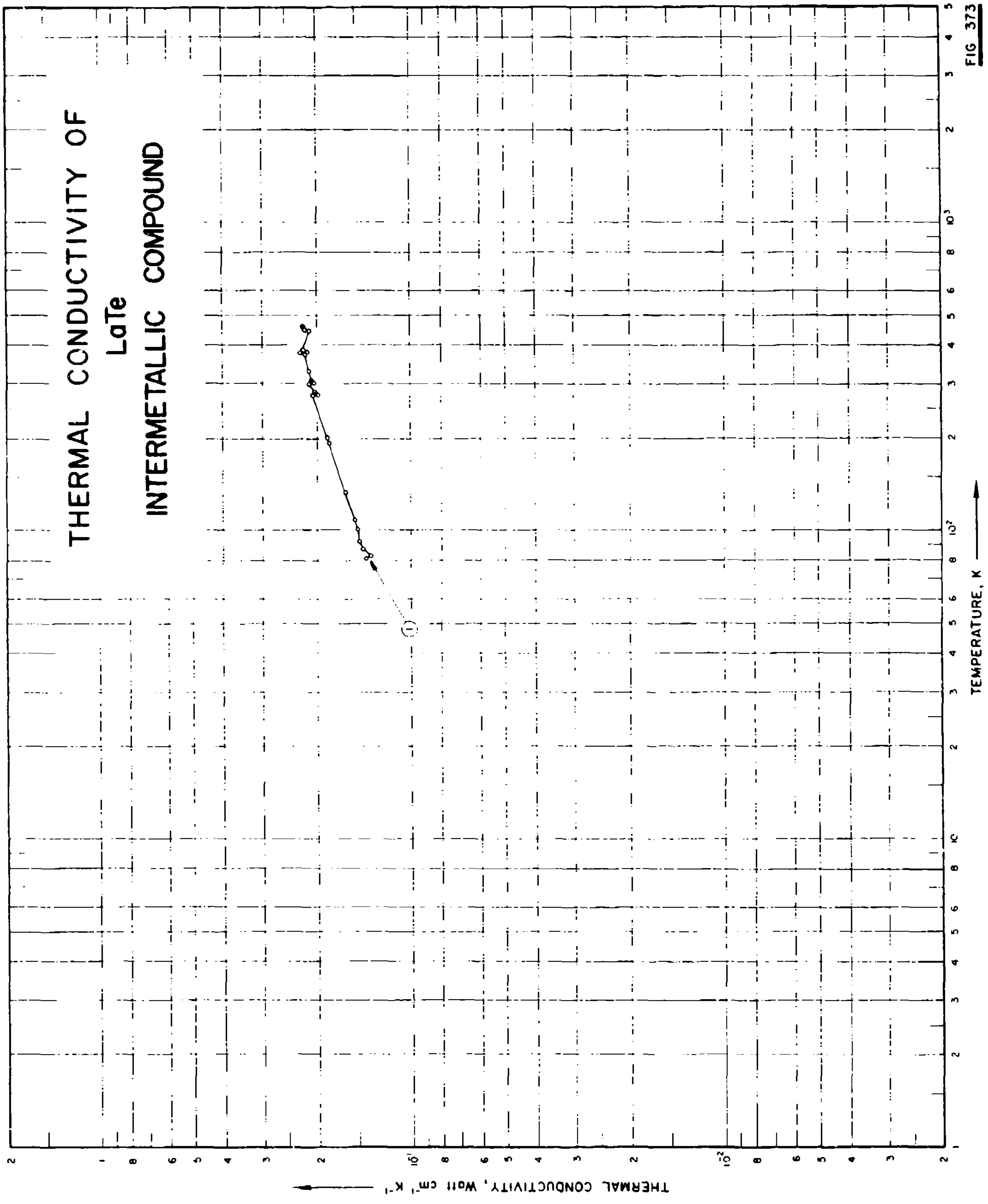
[For Data Reported in Figure and Table No. 372]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	932, 933	L	1966	82–449	±3 – ±5	LaSe	NaCl type compound with ionic-metallic type bending; prepared by pressing powders of the compound under a pressure of about 8000 kg cm^{-2}, sintering in a vacuum of $\sim 10^{-5}$ Torr for 1 to 2 hrs. at 1600 to 1800 C; electrical resistivity reported as 2.12 ~ 6.63 μ ohm cm in the range 5 - 461 K; measured in a vacuum of $10^{-4} \sim 10^{-5}$ mm Hg.

DATA TABLE NO. 372 THERMAL CONDUCTIVITY OF LaSe INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
82	0.150
97	0.156
109	0.161
128	0.169
148	0.176
199	0.192
201	0.195
213	0.197
221	0.199
236	0.204
302	0.220
310	0.223
318	0.223
331	0.228
389	0.235
399	0.238
445	0.241
449	0.241


THERMAL CONDUCTIVITY OF
LaTe
INTERMETALLIC COMPOUND
FIG 373
1
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
10^{-1}
10^{-2}
10^{2}
10^{3}
10

SPECIFICATION TABLE NO. 373 THERMAL CONDUCTIVITY OF LaTe INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 373]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	932, 933	L	1966	81-457	±3-±5	LaTe	NaCl type compared with ionic-metallic type bending; prepared by pressing powders of the compound under a pressure of about 8000 kg cm^{-2}, sintering in a vacuum of ~10^{-5} Torr for 1 to 2 hrs at 1600 to 1800 C; electrical resistivity reported as 1.70 ~ 5.29 μ ohm cm in the range 84 ~463 K; measured in vacuum of 10^{-4} ~ 10^{-5} mm Hg.

DATA TABLE NO. 373 THERMAL CONDUCTIVITY OF LaTe INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
81	0.141
83	0.137
87	0.144
92	0.147
101	0.149
108	0.152
133	0.162
192	0.184
200	0.186
275	0.207
276	0.199
279	0.201
281	0.205
299	0.213
301	0.206
301	0.208
308	0.210
328	0.213
374	0.220
376	0.228
378	0.216
383	0.223
447	0.214
449	0.220
453	0.222
457	0.223

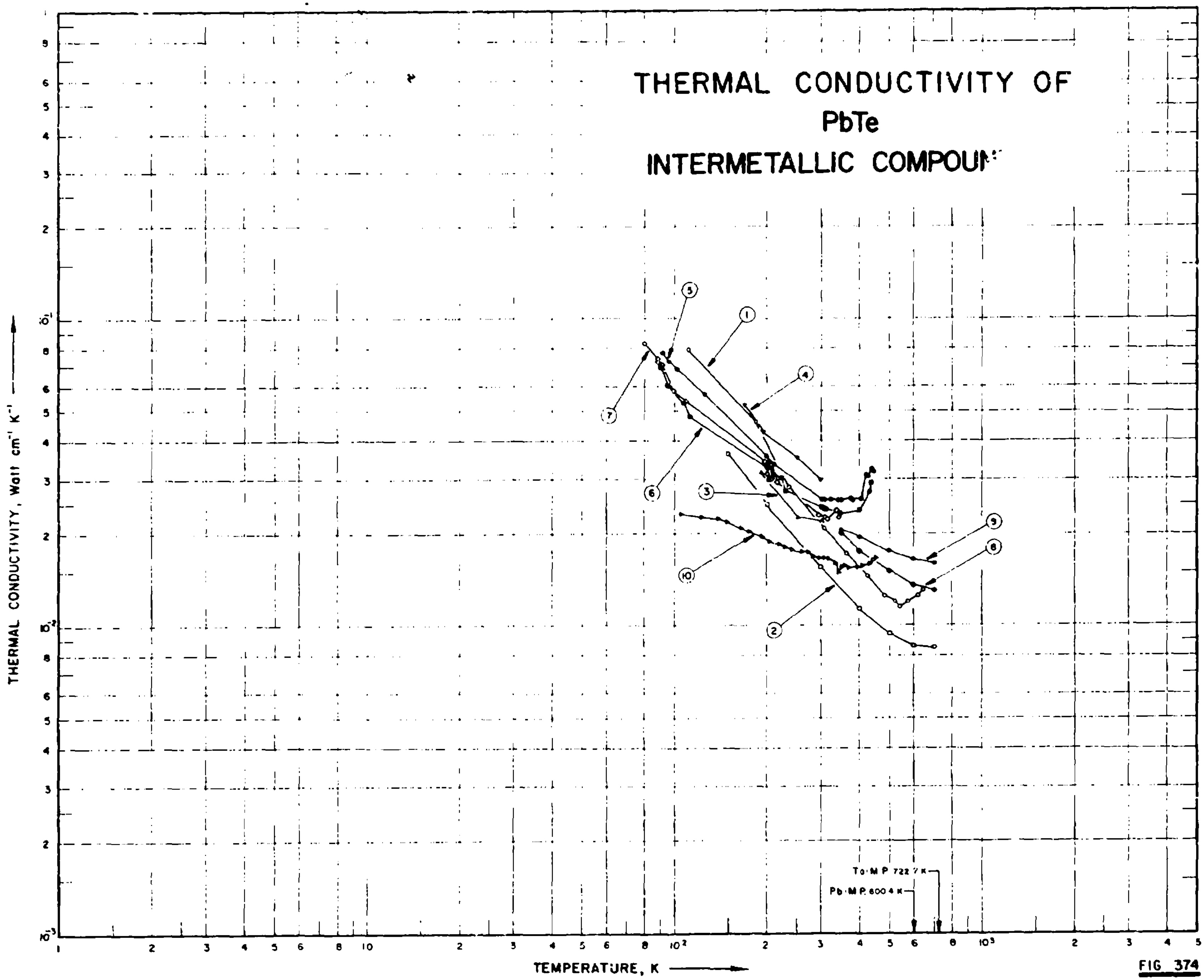

THERMAL CONDUCTIVITY OF
PbTe
INTERMETALLIC COMPOUN
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Te: M.P. 722.7 K
Pb: M.P. 600.4 K

FIG 374

SPECIFICATION TABLE NO. 374 THERMAL CONDUCTIVITY OF PbTe INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 374]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	307	P	1959	112-647		PbTe	Single crystal; hole concentration 2 x 10^{18} cm^{-3}; thermal conductivity calculated from measurements of thermal diffusivity using specific heat values of Parkinson and Quarrington at temperatures higher than room condition, and using 12 cal $mole^{-1}$ for temperatures less than room condition.
2	380	P	1958	150-700		PbTe	Data determined by the same method (improved) as the above.
3	381, 329	L	1957	193-302		PbTe	Polycrystal; electrical conductivity at room temperature, σ = 60 ohm^{-1} cm^{-1}.
4	381, 329	L	1957	170-300		PbTe	Similar to the above specimen but σ = 1740 ohm^{-1} cm^{-1}.
5	381, 329	L	1957	92-446		PbTe	Similar to the above specimen but σ = 1200 ohm^{-1} cm^{-1}.
6	381, 329	L	1957	90-440		PbTe	Similar to the above specimen but σ = 430 ohm^{-1} cm^{-1}.
7	381, 329	L	1957	79-344		PbTe	Similar to the above specimen but σ = 60 ohm^{-1} cm^{-1}.
8	548	L	1961	350-700		PbTe	p-type; density 8.15 g cm^{-3}.
9	548	L	1961	350-700		PbTe	n-type; density 8.15 g cm^{-3}.
10	554	L	1966	106-451		PbTe	p-type stoichiometric single crystal; prepared by melting 99.999 pure Pb and Te in a 6 mm dia quartz phial (to which a 1 mm dia x 15 mm long capillary was attached) under a vacuum of 10^{-2} Torr at 1000 C for 100 hrs, annealed at 200 C for 4 to 8 hrs; electrical resistivity reported as 0.0114, 0.0123, 0.0142, 0.0160, 0.0187, 0.0230, 0.0270, 0.0324, 0.0476, 0.0622, 0.0735, 0.0963, 0.119, 0.146, 0.174, 0.220, 0.277, 0.312, 0.365, 0.407, 0.406, and 0.219 ohm cm at 113, 122, 132, 153, 175, 191, 211, 234, 275, 301, 313, 336, 357, 382, 394, 415, 450, 478, 493, 508, 658, and 794 K respectively.

DATA TABLE NO. 374 THERMAL CONDUCTIVITY OF PbTe INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

CURVE 1

T	k
112.2	0.0791
185.8	0.0460
237.2	0.0283
308.1	0.0209
364.9	0.0172
427.7	0.0146
483.1	0.0125
523.7	0.0120
541.9	0.0115
576.4	0.0119
620.0	0.0125
647.0	0.0130

CURVE 2

T	k
150	0.0361
200	0.0248
300	0.0155
400	0.0113
500	0.00937
600	0.00887
700	0.00849

CURVE 3

T	k
193	0.0314
252	0.0226
302	0.0218

CURVE 4

T	k
170	0.0523
195	0.0427
252	0.0351
300	0.0297

CURVE 5

T	k
92	0.0770
96	0.0728
103	0.0686
126	0.0565
200	0.0356

CURVE 5 (cont.)

T	k
205	0.0343
212	0.0335
302	0.0257
309	0.0256
323	0.0257
342	0.0257
350	0.0257
376	0.0259
382	0.0256
385	0.0358
390	0.0256
394	0.0257
405	0.0259
410	0.0260
420	0.0310
427	0.0305
430	0.0300
435	0.0314
440	0.0322
446	0.0318

CURVE 6

T	k
90	0.0690
95	0.0607
107	0.0515
113	0.0477
200	0.0326
204	0.0297
210	0.0310
224	0.0301
230	0.0272
300	0.0243
307	0.0241
314	0.0238
346	0.0234
394	0.0230*
400	0.0239
431	0.0272
440	0.0293

CURVE 7

T	k
79	0.0837
88	0.0741
88	0.0720
92	0.0703
100	0.0586
108	0.0548
197	0.0343
200	0.0310
206	0.0297
208	0.0335
216	0.0293
295	0.0230
310	0.0226
317	0.0224
338	0.0238
344	0.0226

CURVE 8

T	k
350	0.02
400	0.0175
500	0.015
600	0.0135
700	0.013

CURVE 9

T	k
350	0.0205
400	0.0195
500	0.0175
600	0.0165
700	0.016

CURVE 10

T	k
106	0.0232
124	0.0226
139	0.0224
149	0.0219
165	0.0209
175	0.0204
193	0.0195
204	0.0188

CURVE 10 (cont.)

T	k
220	0.0184
229	0.0180
242	0.0177
260	0.0174
272	0.0173
281	0.0169
296	0.0167
300	0.0167*
308	0.0167
318	0.0165
333	0.0160
342	0.0158
352	0.0156
359	0.0157
368	0.0154
371	0.0154*
397	0.0155
408	0.0157
433	0.0159
445	0.0163
451	0.0166

* Not shown on plot

SPECIFICATION TABLE NO. 375 THERMAL CONDUCTIVITY OF Mg_3Sb_2 INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	547		1948	333.2	≤ 6	Mg_3Sb_2: 1	Specimen prepared by fusing in an inert atmosphere, Mg (electrical conductivity σ, 22.4 x 10^4 $ohm^{-1}cm^{-1}$ at 20 C and thermal conductivity k, 1.548 watt $cm^{-1}K^{-1}$ at 25 C) and Sb (σ = 2.57 x 10^4 $ohm^{-1}cm^{-1}$ at 20 C and k = 0.184 watt $cm^{-1}K^{-1}$ at 25 C); annealed at 500-600 C for 10-12 hrs; electrical conductivity 0.77 x 10^4 $ohm^{-1}cm^{-1}$ at 20 C.
2	547		1948	333.2	< 6	Mg_3Sb_2: 2	As above except the electrical conductivity, 0.36 x 10^4 at 20 C.
3	547		1948	333.2	< 6	Mg_3Sb_2: 3	As above except the electrical conductivity, 0.30 x 10^4 at 20 C.
4	547		1948	333.2	< 6	Mg_3Sb_2: 4	As above except the electrical conductivity, 0.22 x 10^4 at 20 C.

DATA TABLE NO. 375 THERMAL CONDUCTIVITY OF Mg_3Sb_2 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
333.2	0.0502
CURVE 2*	
333.2	0.0360
CURVE 3*	
333.2	0.0209
CURVE 4*	
333.2	0.0109

* No graphical presentation

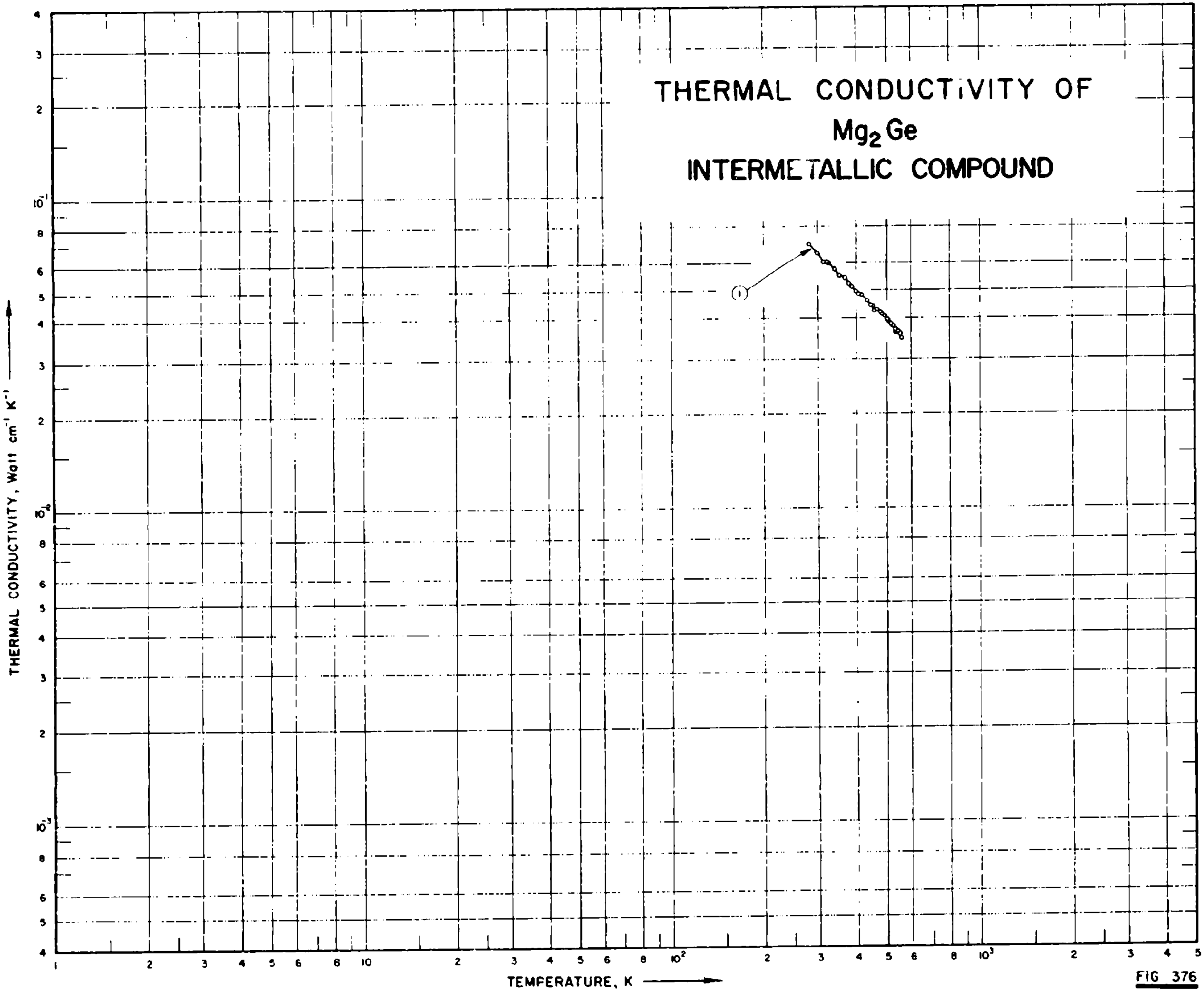

THERMAL CONDUCTIVITY OF
Mg2 Ge
INTERMETALLIC COMPOUND
1
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 376

SPECIFICATION TABLE NO. 376 THERMAL CONDUCTIVITY OF Mg_2Ge INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 376]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	955	L	1963	280-561	± 6	Mg_2Ge	Stoichiometric composition; polycrystalline; 2.34 cm^2 x 1.61 cm long; prepared by fusion of the transistor grade Ge obtained from Eagle Picher Company and 99.99$^+$ pure sublimed Mg from Dow Metal Products Company, materials weighed and loaded into a graphite crucible, put into a stainless steel tube, evacuated, heated to 500-600 C in an induction furnace, cooled back to room temperature, filled the system with argon to a pressure of 20 psia, heated rapidly to 30-40 C above the melting temperature of compound, transferred to a resistance furnace (preheated to the same temperature), soaked for about 5 min, placed the system near the end of the furnace which was then cooled at 15 C hr^{-1} to a temperature 15 C below the freezing temperature, specimen held at 30 C below the freezing temperature for about 12 hrs, then cooled to room temperature at about 100 C hr^{-1}.

DATA TABLE NO. 376 THERMAL CONDUCTIVITY OF Mg_2Ge INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
280	0.0699
299	0.0646
312	0.0608
324	0.0608
326	0.0601
340	0.0580
352	0.0551
366	0.0543
377	0.0525
386	0.0512
398	0.0498
409	0.0488
417	0.0484
431	0.0461
442	0.0448
450	0.0441
458	0.0427
467	0.0430
478	0.0422
484	0.0413
491	0.0410
502	0.0398
509	0.0393
517	0.0383
524	0.0379
534	0.0369
540	0.0362
547	0.0362
553	0.0356
561	0.0348

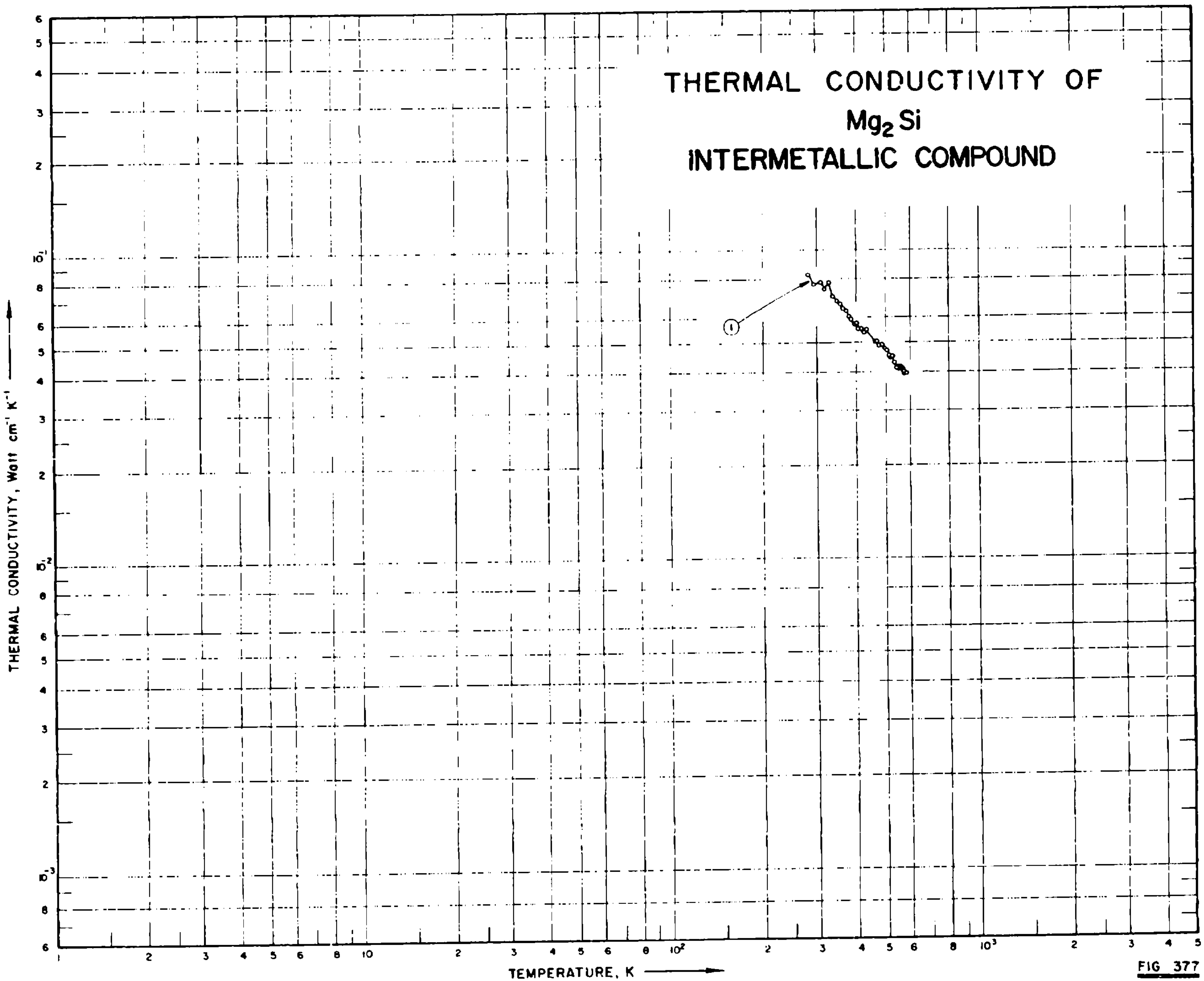

THERMAL CONDUCTIVITY OF
Mg_2Si
INTERMETALLIC COMPOUND
1
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K

FIG 377

SPECIFICATION TABLE NO. 377 THERMAL CONDUCTIVITY OF Mg_2Si INTERMETALLIC COMPOUND

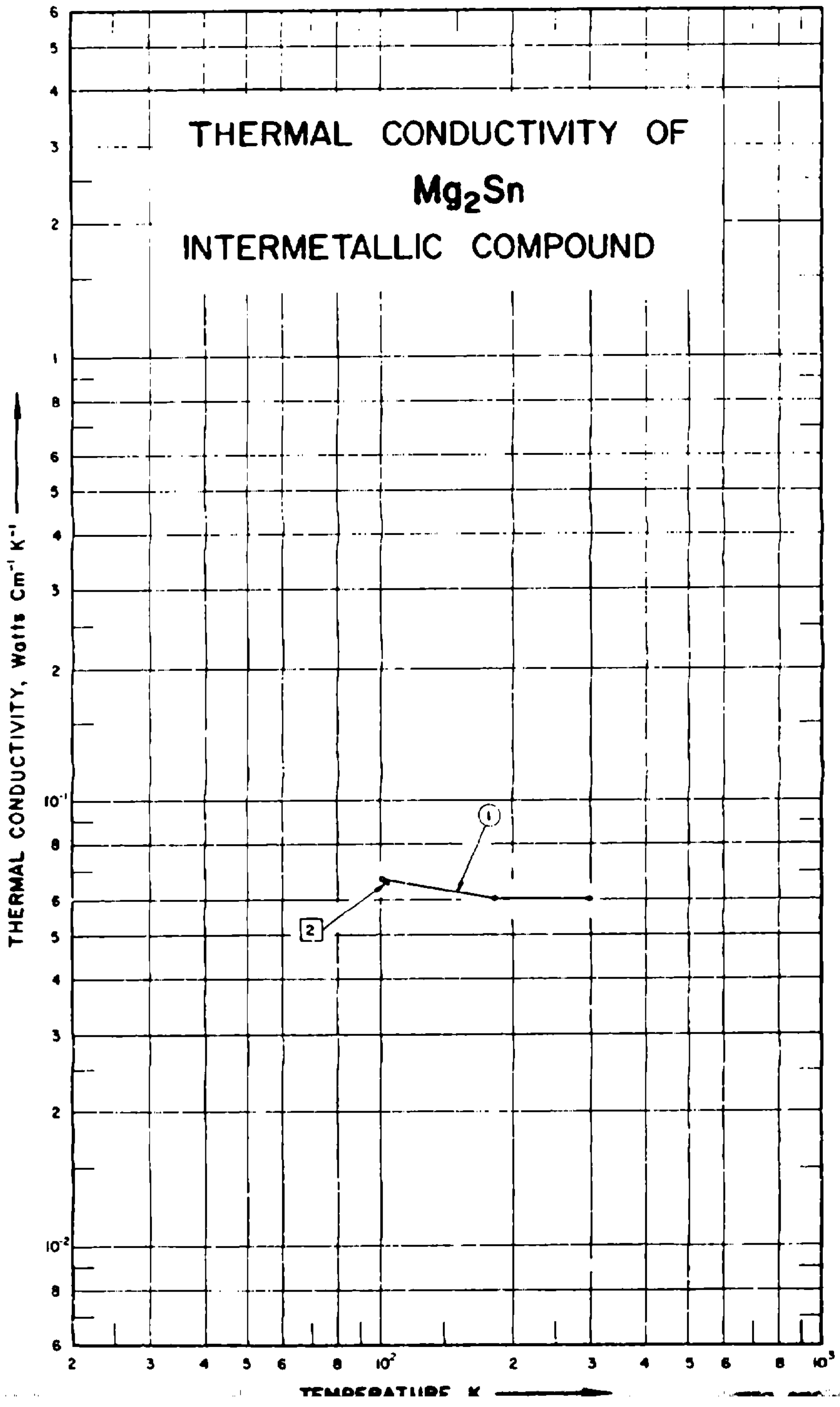
[For Data Reported in Figure and Table No. 377]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	955	L	1963	281-590	± 6	Mg_2Si	Stoichiometric composition; polycrystalline; 1.57 cm^2 x 1.61 cm long; prepared by fusion of the transistor grade Si from Allegheny Electronic Chemicals Company and 99.99+ pure sublimed Mg from Dow Metal Products Company, materials weighed (with 1% excess of Si) and loaded into a graphite crucible, put into a stainless steel tube, evacuated, heated to 500 ~ 600 C in an induction furnace, cooled back to room temperature, filled the system with argon to a pressure of 20 psia, heated rapidly to 30 ~ 40 C above the melting temperature of compound, transferred to a resistance furnace (preheated to the same temperature), soaked for about 5 min, placed the system near the end of the furnace, which was then cooled at 15 C hr^{-1} to a temperature 15 C below the freezing temperature, specimen held at 30 C below the freezing temperature for about 12 hrs, then cooled to room temperature at about 100 C hr^{-1}.

DATA TABLE NO. 377 THERMAL CONDUCTIVITY OF Mg_2Si INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
281	0.0836
294	0.0779
307	0.0793
317	0.0747
328	0.0791
339	0.0704
349	0.0680
357	0.0666
365	0.0647
373	0.0633
381	0.0610
389	0.0596
398	0.0577
403	0.0580
409	0.0559
420	0.0559
427	0.0542
433	0.0552
462	0.0507
469	0.0507
479	0.0491
489	0.0494
496	0.0480
504	0.0472
511	0.0454
519	0.0451
528	0.0451
534	0.0431
541	0.0414
548	0.0420
552	0.0412
557	0.0418
565	0.0411
571	0.0401
575	0.0394
580	0.0398


THERMAL CONDUCTIVITY OF
Mg_2Sn
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}
TEMPERATURE, K
1
2

SPECIFICATION TABLE NO. 378 THERMAL CONDUCTIVITY OF Mg_2Sn INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 378]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	542	C	1962	101-298	±20	Pl-2; Mg_2Sn	n-type single crystal; specimen in circular form 12.3 mm in dia and 7.2 mm long; measured in a pressure of 5×10^{-5} mm Hg; Inconel 702 used as comparative material.
2	542	C	1962	103	±20	Pl-2; Mg_2Sn	The above specimen measured with magnetic induction of 8000 gauss; Inconel 702 used as comparative material.

DATA TABLE NO. 378 THERMAL CONDUCTIVITY OF Mg_2Sn INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
101	0.0671
181	0.0697
298	0.0604
CURVE 2	
103	0.066

SPECIFICATION TABLE NO. 379 THERMAL CONDUCTIVITY OF HgSe INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	368	C, L	1954	298.2	0.2-3.0	Hg Se	Electrical conductivity 1840 and 1870 $ohm^{-1}cm^{-1}$ at 25 and respectively.

DATA TABLE NO. 379 THERMAL CONDUCTIVITY OF HgSe INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.0176

* No graphical presentation

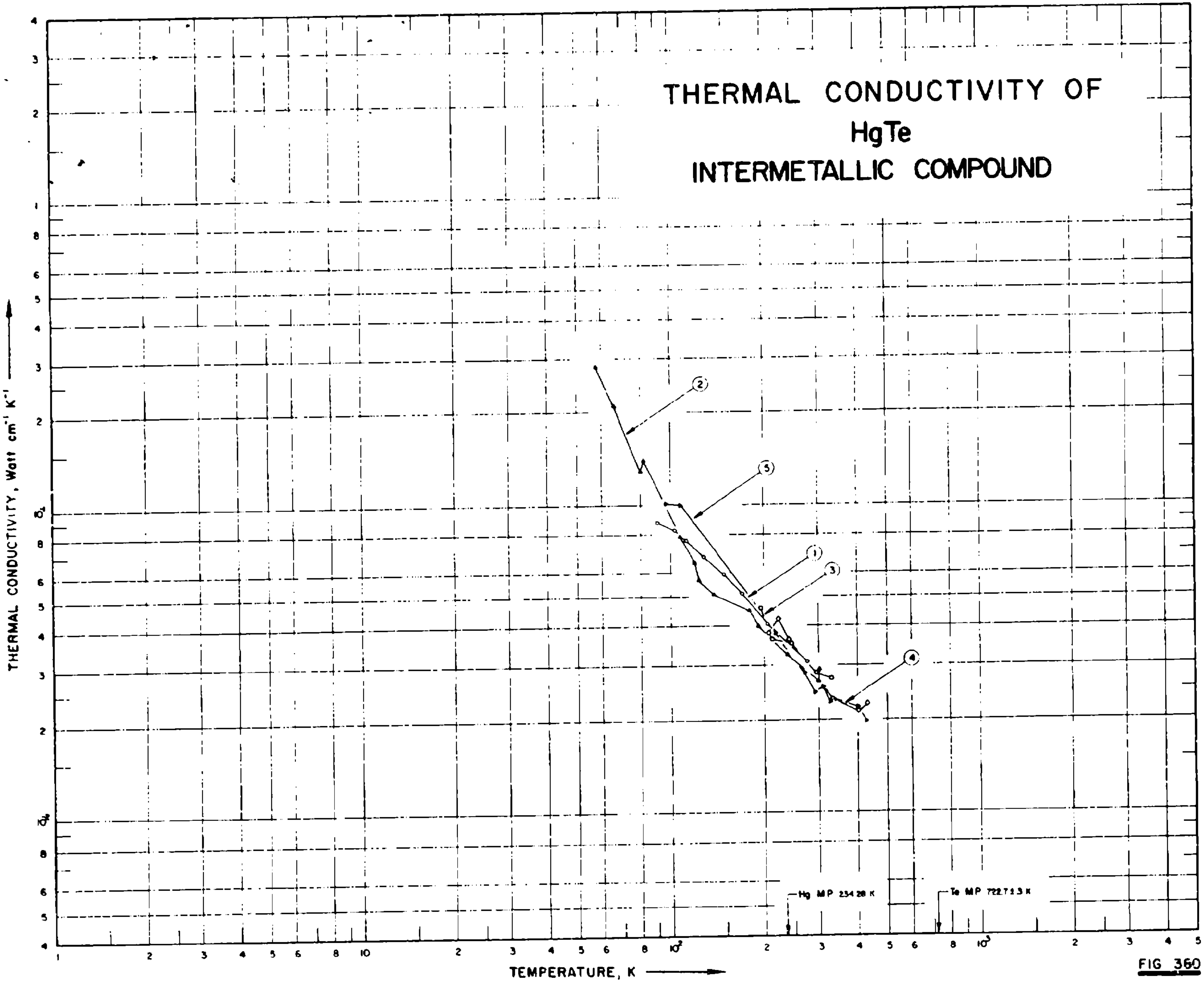

THERMAL CONDUCTIVITY OF
HgTe
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
Hg MP 234.28 K
Te MP 722.7±3 K
1
2
3
4
5

FIG 360

SPECIFICATION TABLE NO. 380 THERMAL CONDUCTIVITY OF HgTe INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 380]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	520	L	1960	91-276	±5	HgTe; No. 18	Single crystal; specimen ~0.1 x 0.1 x 0.1 in.
2	915	L	1958	58-302		HgTe	p-type polycrystalline specimen 2 x 4 x 10 mm; prepared from 99.99* Hg and 99.999 Te; supplied by American Smelting and Refining Co.; acceptor concentration about 1.5 x 10^{18} cm^{-3}; melting point ~680 C.
3	957, 959	L	1965	196-330	6		p-type; impurity concentration ~3 x 10^{17} cm^{-3}; measured in a vacuum of ~10^{-4} mm Hg.
4	957, 958	L	1965	207-431	6		p-type; impurity concentration ~5 x 10^{17} cm^{-3}; measured in a vacuum of ~10^{-4} mm Hg.
5	957, 958	L	1965	97-427	6		p-type; impurity concentration ~10^{19} cm^{-3}; measured in a vacuum of ~10^{-4} mm Hg.

DATA TABLE NO. 380 THERMAL CONDUCTIVITY OF HgTe INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k
CURVE 1		**CURVE 5**	
90.9	0.0879	97	0.1012
103.1	0.0828	108	0.1001
113.4	0.0763	219	0.0380
128.2	0.0678	271	0.0282
148.6	0.0592	292	0.0244
170.9	0.0512	309	0.0254
206.2	0.0406	328	0.0227
276.2	0.0309	337	0.0230
		402	0.0219
CURVE 2		427	0.0197
58	0.283		
66	0.210		
80	0.129		
82	0.140		
108	0.0790		
120	0.0650		
123.5	0.0570		
139.5	0.0510		
180	0.0450		
192	0.0400		
239	0.0325		
300	0.0265		
301.5	0.0290		
CURVE 3			
196	0.0456		
212	0.0364		
246	0.0353		
295	0.0282		
330	0.0271		
CURVE 4			
207	0.0380		
223	0.0421		
241	0.0361		
291	0.0282*		
334	0.0233		
404	0.0213		
431	0.0224		

* Not shown on plot

FIGURE SHOWS ONLY 5 OF THE CURVES REPORTED IN TABLE

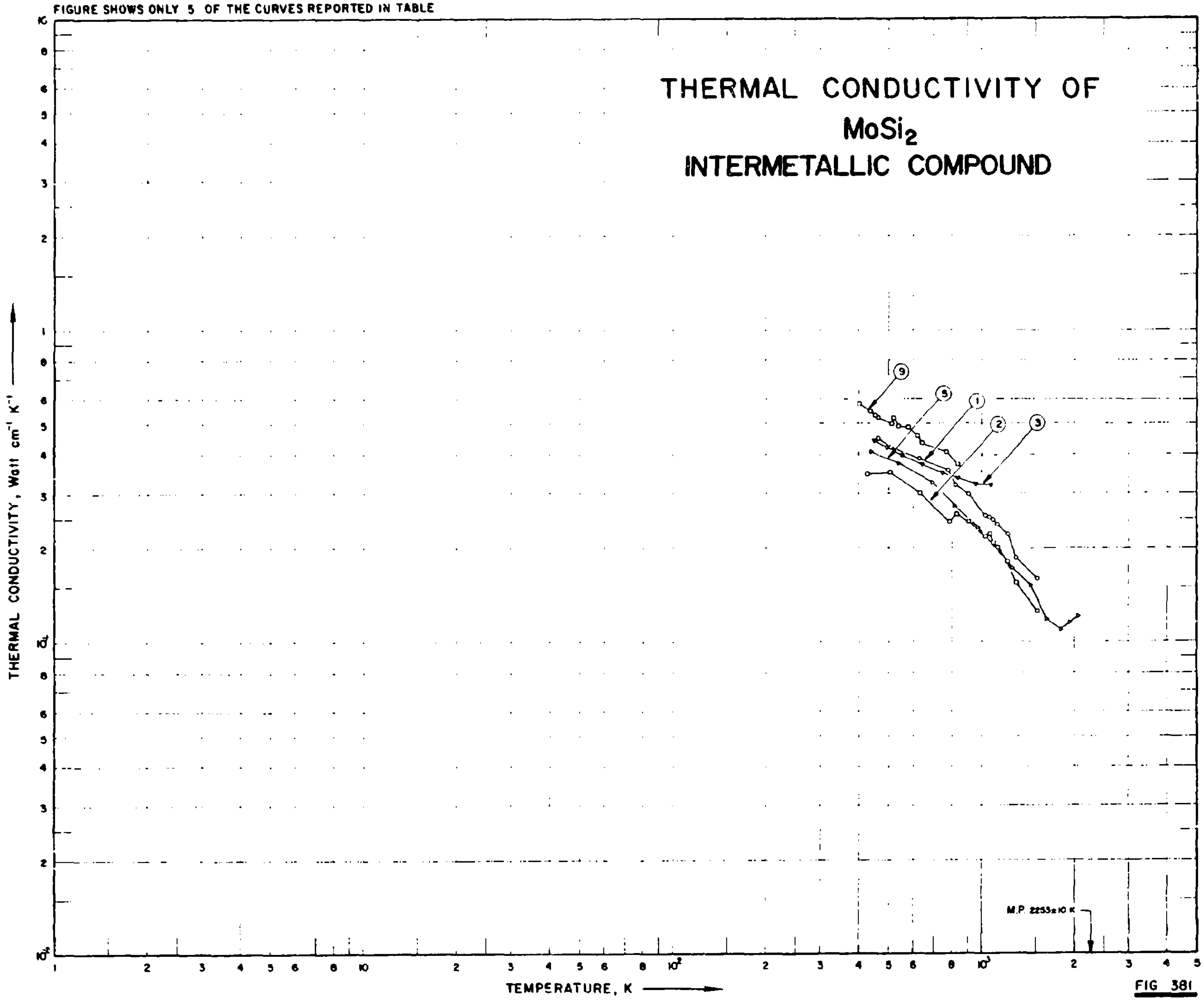


FIG 381

SPECIFICATION TABLE NO. 381 THERMAL CONDUCTIVITY OF $MoSi_2$ INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 381]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	575		1954	424-1517		$MoSi_2$	Supplied by General Electric Co.; run No. 1.
2	575		1954	426-1513		$MoSi_2$	The above specimen; run No. 2.
3	576	C	1954	449-1074	<5	$MoSi_2$; 1-tc	Hot pressed; 0.5 in. dia; supplied by NACA; density 6.08 g cm^{-3}; stainless steel used as standard.
4	576	C	1954	471-1097	<5	$MoSi_2$; 2-tc	Similar to the above except density 6.02 g cm^{-3}.
5	614	R	1961	437-2058	<5	$MoSi_2$	Slip cast; 1 in. dia, 1 in. thick; density 5.80 g cm^{-3}; measured in a He atmosphere.
6	576	C	1954	449-1074	<5	$MoSi_2$; 1-tc	Molybdenum disilicide; 62.0 Mo, 36.3 Si, 1.0 Fe, and 0.8 O; furnished by NACA; hot-pressed; density 6.08 g cm^{-3} (97.5% of theoretical density); stainless steel used as comparative material.
7	576	C	1954	471-1097	<5	$MoSi_2$; 2-tc	Similar to the above specimen except density 6.02 g cm^{-3} (96.5% of theoretical density).
8	571	L	1954	607-1062	10	$MoSi_2$; 5-tc	Molybdenum disilicide; 62.0 Mo, 36.3 Si, 0.8 Fe, 0.5 O, 0.34 N, and 0.17 C; specimen 3.5 in. long and 0.5 in. in dia; supplied by Lewis Flight Propulsion Lab; density 6.12 g cm^{-3} (98% of theoretical density).
9	572	C	1950	404-840		$MoSi_2$	Molybdenum disilicide; 62.4-62.8 Mo, 36.6-36.7 Si, and 0.5-1.0 Te; estimated composition; specimen 0.5 in. in dia and 7 in. long; hot-pressed from nonuniform powder and etched with a solution containing 17% HCl and 8% HNO_3 for 70 min; density ~5.91 g cm^{-3}; nickel used as comparative material.

DATA TABLE NO. 381 THERMAL CONDUCTIVITY OF $MoSi_2$ INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
424.2	0.450
506.2	0.423
630.7	0.387
781.2	0.356
825.2	0.318
905.2	0.297
1033.2	0.255
1061.2	0.252
1093.2	0.248
1129.2	0.238
1216.2	0.222
1297.2	0.186
1517.2	0.159
CURVE 2	
426.2	0.345
506.2	0.349
631.7	0.299
788.2	0.244
832.2	0.258
905.2	0.244
1036.2	0.218
1067.2	0.222
1095.2	0.208
1127.2	0.201
1213.2	0.180
1298.2	0.154
1513.2	0.126
CURVE 3	
448.8	0.443
491.3	0.422
552.5	0.397
643.8	0.371
749.9	0.348
839.8	0.336
957.1	0.320
1073.8	0.317
CURVE 4*	
470.6	0.423
517.4	0.402
580.5	0.384
676.1	0.356
778.7	0.346
869.3	0.332
983.2	0.321
1097.0	0.317
CURVE 5	
437.1	0.407
542.1	0.375
695.9	0.324
819.3	0.275
967.6	0.235
1104.3	0.203*
1255.9	0.173
1441.5	0.153
1623.2	0.118
1812.6	0.109
1933.7	0.115
2058.2	0.121
CURVE 6*	
448.8	0.443
491.3	0.422
552.5	0.397
643.8	0.371
749.9	0.348
839.8	0.336
957.1	0.320
1073.8	0.317
CURVE 7*	
470.6	0.423
517.4	0.402
580.5	0.384
CURVE 7 (cont.)*	
676.1	0.356
778.7	0.346
869.3	0.332
983.2	0.321
1097.0	0.317
CURVE 8*	
607.3	0.389
613.4	0.384
655.1	0.369
664.5	0.368
666.1	0.364
703.2	0.354
706.6	0.356
712.1	0.352
787.9	0.329
799.8	0.326
801.3	0.315
853.2	0.322
855.5	0.314
958.0	0.294
961.6	0.297
1048.9	0.306
1061.6	0.297
CURVE 9	
404.0	0.577
436.0	0.545
451.2	0.5287
464.3	0.524
514.7	0.4993
520.3	0.520
539.4	0.490
583.2	0.485
620.4	0.4565
643.2	0.434
766.5	0.407
839.8	0.371

* Not shown on plot

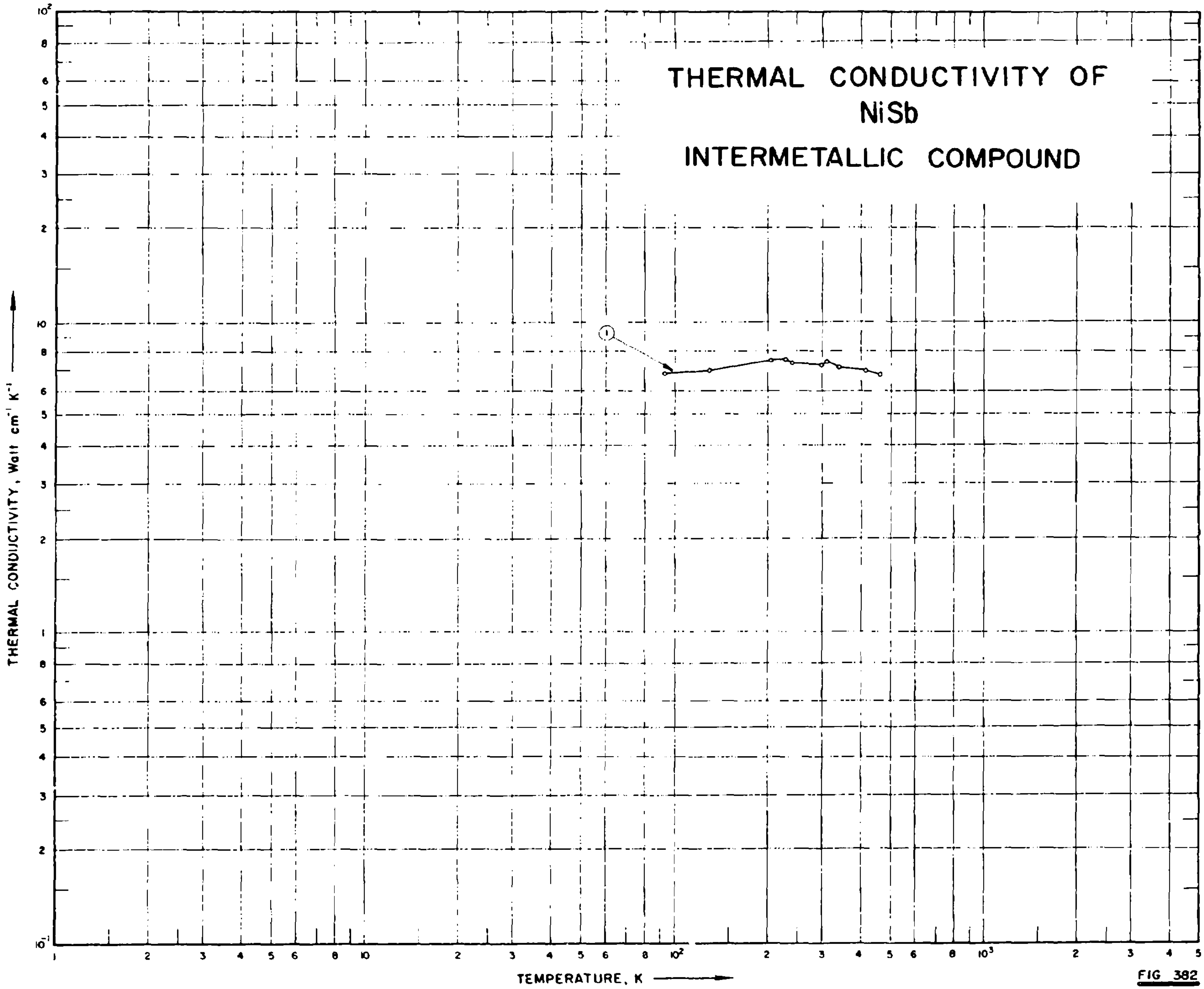

THERMAL CONDUCTIVITY OF
NiSb
INTERMETALLIC COMPOUND
1
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 382

SPECIFICATION TABLE NO. 382 THERMAL CONDUCTIVITY OF NiSb INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 382]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	959		1966	93–456		NiSb	Specimen 7 x 7 x 30 mm; electrical resistivity 3.45, 8.01, 8.78, 9.97, 10.75, 10.42, 11.55, 10.06, 14.80, 14.76, 16.15, and 16.68 μohm cm at 79, 214, 241, 274, 281, 289, 325, 376, 416, 424, 474 and 483 K respectively.

DATA TABLE NO. 382 THERMAL CONDUCTIVITY OF NiSb INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
93	0.682
130	0.697
205	0.749
229	0.751
240	0.731
298	0.724
311	0.741
340	0.712
412	0.694
466	0.678

SPECIFICATION TABLE NO. 383 THERMAL CONDUCTIVITY OF Re_3As_7 INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	960		1961	303.2		Re_3As_7	Electrical resistivity 1.10×10^{-3} ohm cm at 30 C.

DATA TABLE NO. 383 THERMAL CONDUCTIVITY OF Re_3As_7 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
303.2	0.024

* No graphical presentation

SPECIFICATION TABLE NO. 384 THERMAL CONDUCTIVITY OF Re_xGe_y INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	574		1961	393-563		ReGe	Hot pressed at 1700 F; density 8.68 g cm^{-3}; electrical resistivity 1079, 1601, 1721, 1761, 1810, 1763, 1717, 1774, 1736, 1794, 1743, and 1695 μ ohm cm at 25, 44, 79, 90, 120, 143, 165, 170, 204, 224, 259, and 283 C respectively.
2	960		1961	303.2		$ReGe_2$	Electrical resistivity 1.55 x 10^{-3} ohm cm at 30 C.

DATA TABLE NO. 384 THERMAL CONDUCTIVITY OF Re_xGe_y INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
393.2	0.050
418.2	0.055
433.2	0.057
483.2	0.060
563.2	0.063
CURVE 2*	
303.2	0.072

* No graphical presentation

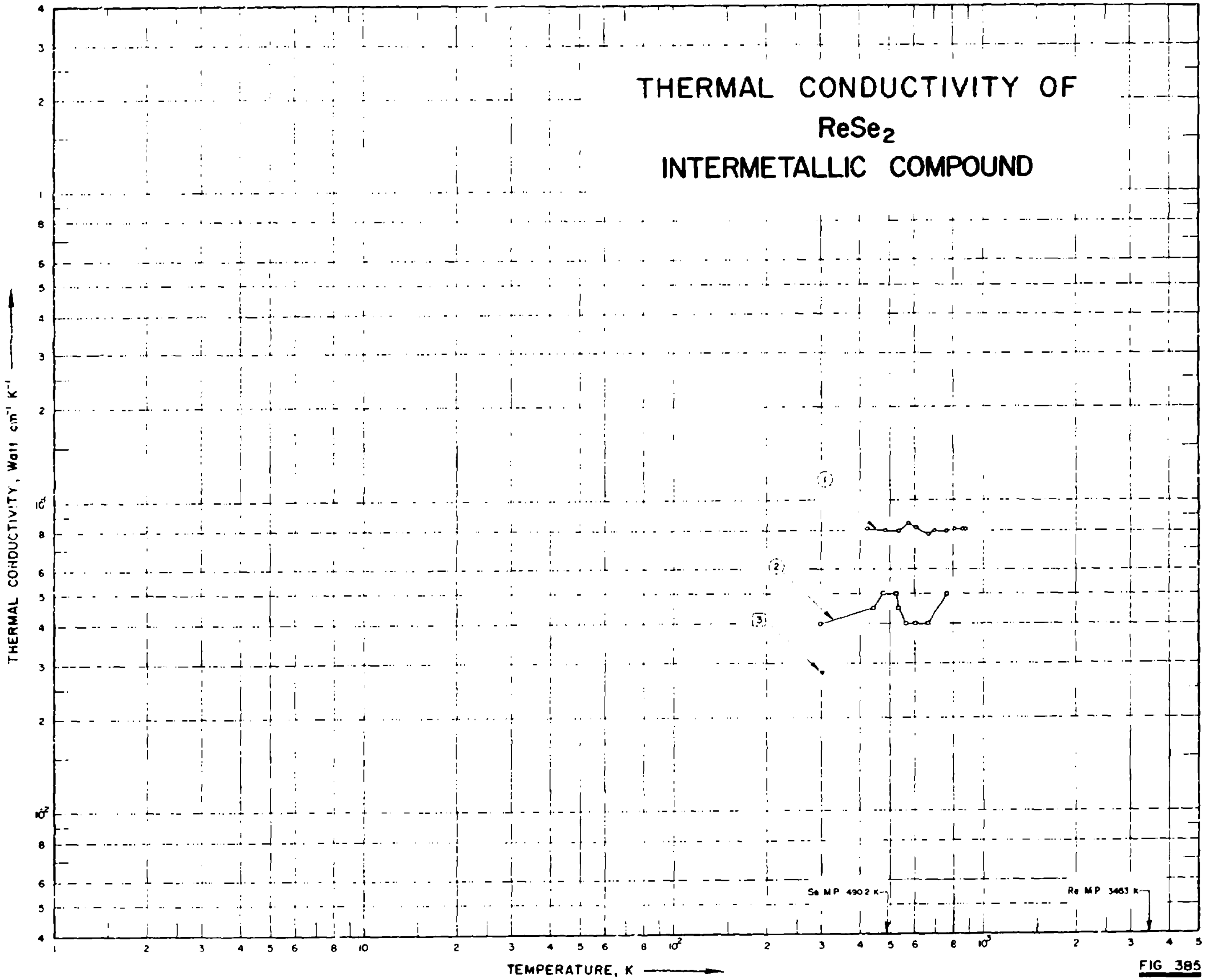

THERMAL CONDUCTIVITY OF $ReSe_2$
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
Se MP 490.2 K
Re MP 3453 K

FIG 385

SPECIFICATION TABLE NO. 385 THERMAL CONDUCTIVITY OF $ReSe_2$ INTERMETALLIC COMPOUNDS

(For Data Reported in Figure and Table No. 385)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	574		1961	423-873		$ReSe_2$	Very faint trace of Si; electrical resistivity reported as 1308, 816, 686, 401, 297, 185, 96, 79, 61, 33, 33, 33, 23, 25, 27, 26, 30, 22, 28, 27, 27, 25 ohm cm at 72, 96, 112, 141, 161, 189, 221, 215, 255, 296, 328, 353, 383, 418, 442, 465, 486, 522, 561, 616, 642, and 681 C respectively.
2	574		1961	298-763		$ReSe_2$	Very faint trace of Si; electrical resistivity reported as 470, 269, 110, 8, 30, 53, 62, 75, 81, 71, 63, 49, 34, 31, 22, 13, 6, and 6 ohm cm at 25, 38, 59, 70, 78, 86, 99, 127, 148, 171, 197, 239, 278, 309, 359, 410, 429, 469, and 500 C respectively.
3	960		1961	303.2		$ReSe_2$	Electrical resistivity 2000 ohm cm at 30 C.

DATA TABLE NO. 385 THERMAL CONDUCTIVITY OF $ReSe_2$ INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
423.2	0.081
483.2	0.080
533.2	0.080
573.2	0.085
603.2	0.082
663.2	0.078
693.2	0.080
763.2	0.080
803.2	0.081
853.2	0.081
873.2	0.081
CURVE 2	
298.2	0.040
443.2	0.045
473.2	0.050
523.2	0.050
533.2	0.045
563.2	0.040
608.2	0.040
665.2	0.040
763.2	0.050
CURVE 3	
303.2	0.028

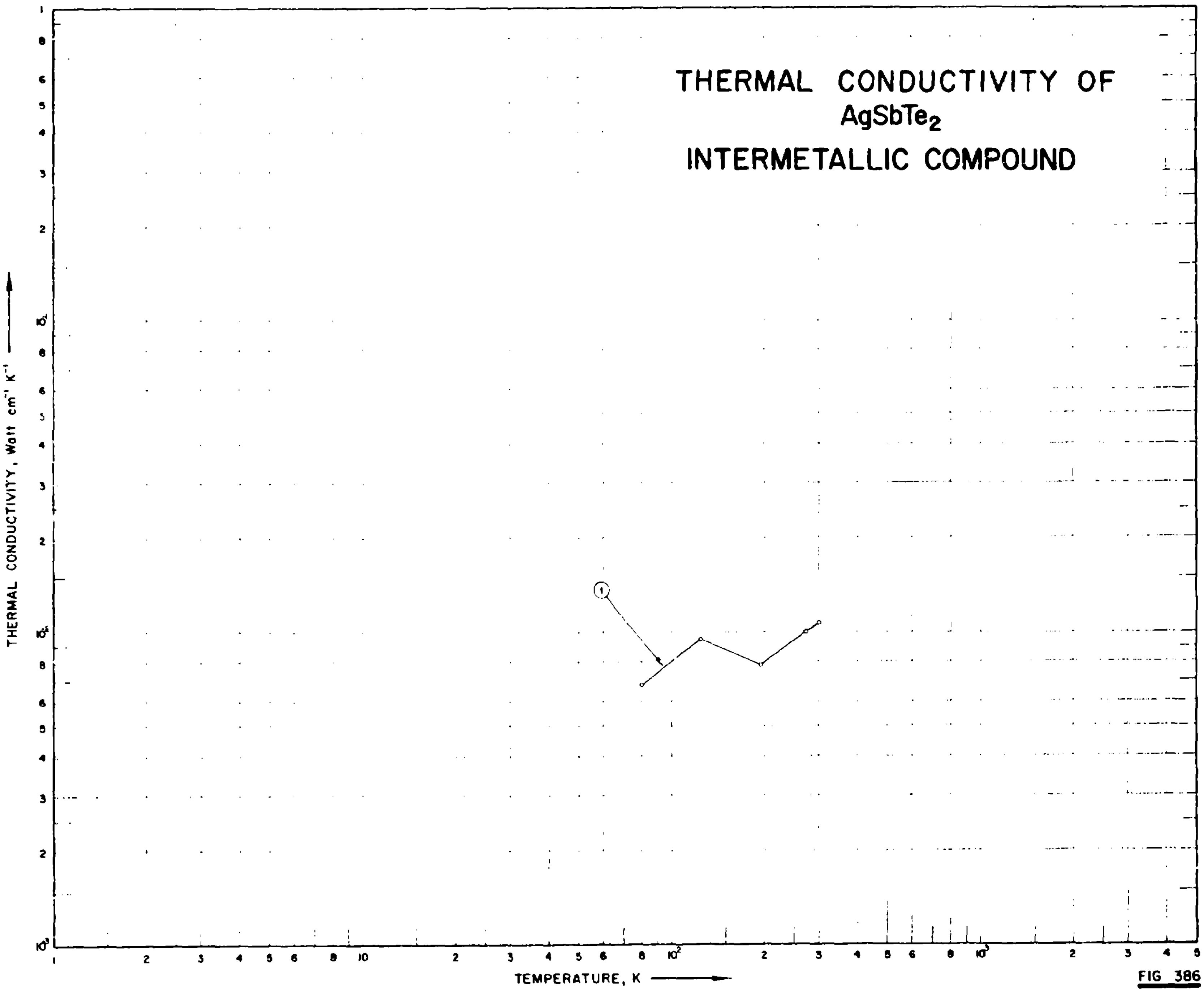

THERMAL CONDUCTIVITY OF
AgSbTe2
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1

FIG 386

SPECIFICATION TABLE NO. 386 THERMAL CONDUCTIVITY OF $AgSbTe_2$ INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 386]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	553, 750	L	1959	80-300		$AgSbTe_2$	p-type; prepared from elements in an evacuated quartz ampoule by heating to 700 C, mixing and cooling at ~ 5 C min^{-1}; electrical resistivity reported as 5.04, 5.00, 4.58, 5.14, 4.44, 4.63, 4.56, 3.94, 4.15, 3.91, 4.35, 3.83, 4.24, and 4.07 milliohm cm at 25, 85, 110, 168, 192, 224, 260, 260, 275, 336, 361, 403, 419, and 478 C, respectively.

DATA TABLE NO. 386 THERMAL CONDUCTIVITY OF $AgSbTe_2$ INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
80	0.0068
125	0.0095
195	0.0078
273	0.0100
300	0.0107

SPECIFICATION TABLE NO. 387 THERMAL CONDUCTIVITY OF Ag Cu INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	230	L	1925	335.2			Specimen ~ 5 cm long with cross section 0.3 cm^2; made from Cu (< 0.03 of total impurity) supplied by Baker, fused with Ag (99.9 pure); electrical conductivity 4.46 x 10^5 ohm^{-1} cm^{-1} at 25 C.

DATA TABLE NO. 387 THERMAL CONDUCTIVITY OF Ag Cu INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
335.2	3.142

* No graphical presentation

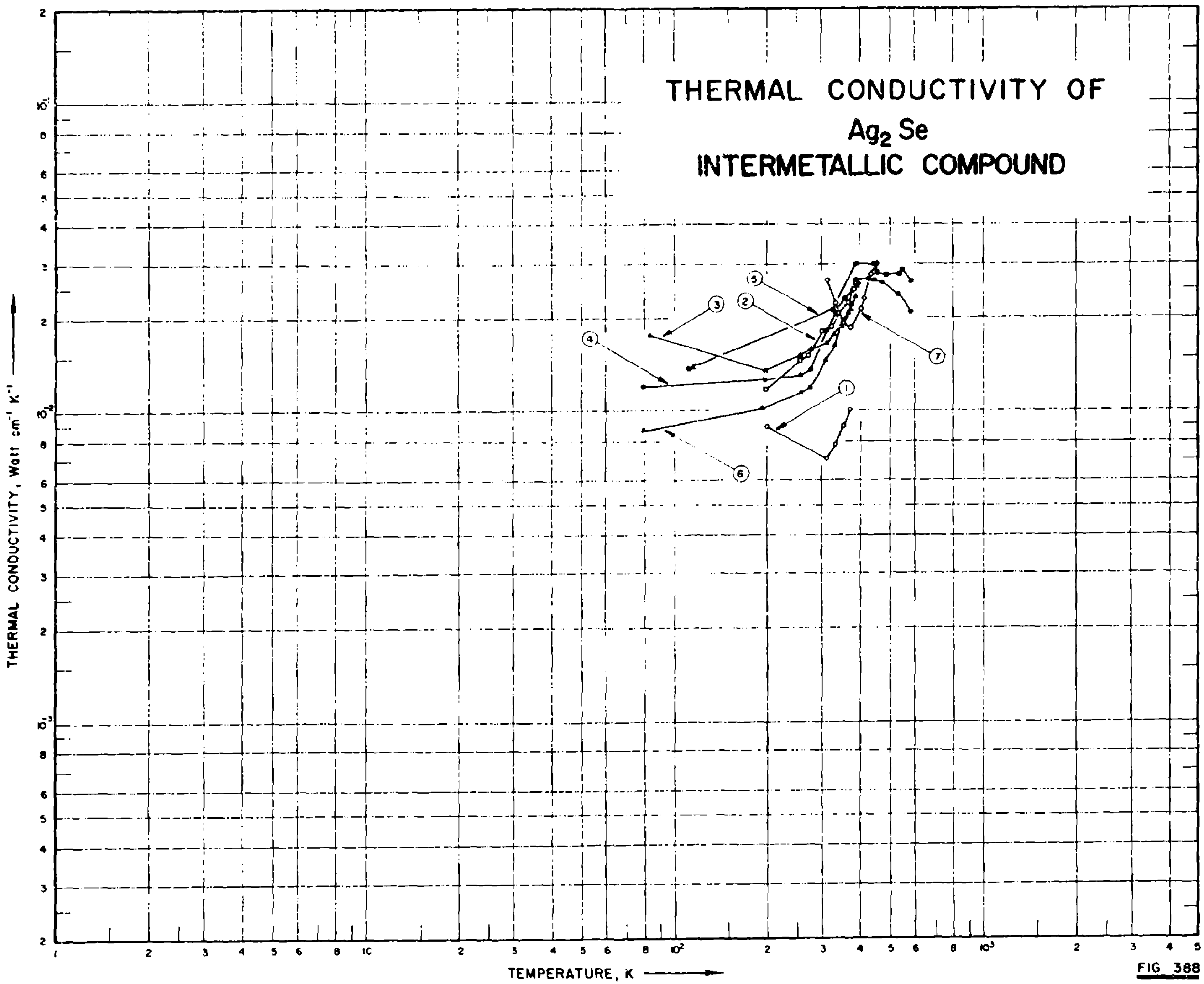

THERMAL CONDUCTIVITY OF
Ag_2Se
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
1
2
3
4
5
6
7

FIG 388

SPECIFICATION TABLE NO. 388 THERMAL CONDUCTIVITY OF Ag_2Se INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 388]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	551	L	1960	288-373		Ag_2Se	Stoichiometric crystalline; 12 mm dia x 19.1 mm long; prepared from 99.999+ Se and 99.99+ Ag from American Smelting and Refining Co., melted in carbon coated quartz tube, evacuated at ~ 10^{-5} mm Hg heated at 1050 ~ 1100 C for 16 hrs; electrical resistivity 10.2 ohm cm.
2	963	L	1962	199-385	5	Ag_2Se;S1	Polycrystalline; prepared by melting appropriate amounts of pure elements in a quartz tube, floating zone melting in a graphite boat under controlled vapor pressure at a speed of 0.5 mm min^{-1} for about 25 passages, slowly cooled 15 ~ 10 degree h^{-1}, to 150 C, then cooled at 1 ~ 2 degree h^{-1} through the transition temperature (133 C), below the transition temperature the specimen annealed for several hrs; carrier concentration 1.2×10^{18} cm^{-3}; electrical resistivity reported as 0.468 ~ 1.98 milliohm cm in the range 85.8 ~ 621.1 K.
3	963	L	1962	84-389	5	Ag_2Se;H1	Polycrystalline; same fabrication method as the above specimen; carrier concentration 1.5×10^{18} cm^{-3}; electrical resistivity reported as 0.462 ~ 1.33 milliohm cm in the range 85.6 ~ 632.9 K.
4	963	L	1962	80-585	5	Ag_2Se;H2	Polycrystalline; same fabrication method as the above specimen; carrier concentration 5.7×10^{17} cm^{-3}; electrical resistivity reported as 0.533 ~ 2.89 milliohm cm in the range 80.4 ~ 645.2 K.
5	963	L	1962	112-588	5	Ag_2Se;H3	Polycrystalline; same fabrication method as the above specimen; carrier concentration 1.2×10^{18} cm^{-3}.
6	963	L	1962	80-395	5	Ag_2Se;F1	Polycrystalline; same fabrication method as the above specimn, carrier concentration 1.0×10^{18} cm^{-3}.
7	943	L	1963	315-451		Ag_2Se	n-type; specimen 8 mm in dia and 12-14 mm long; synthesized in evacuated quartz ampule at 10^{-4} mm Hg, heated to above the melting point of the component with higher melting point for 2 hrs, then heated to the melting point of the compound for 8 hrs; annealed at 700-800C for several hrs and then cooled to room temperature.

DATA TABLE NO. 388 THERMAL CONDUCTIVITY OF Ag_2Se INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
288	0.0089
313	0.0070
333	0.0078
353	0.0089
373	0.010
CURVE 2	
199.2	0.0118
256.4	0.0146
274.7	0.0151
303.0	0.0182
324.7	0.0189
342.5	0.0208
367.6	0.0225
384.6	0.0249
CURVE 3	
83.5	0.0177
197.6	0.0136
257.7	0.0151
277.0	0.0159
312.5	0.0166
330.0	0.0179
348.4	0.0189
366.3	0.0205
377.4	0.0221
389.1	0.0236
CURVE 4	
79.9	0.0120
196.1	0.0127
256.4	0.0131
277.0	0.0137
314.5	0.0183
334.4	0.0207
357.1	0.0230
380.2	0.0245
387.6	0.0263
427.4	0.0269
446.4	0.0266
473.9	0.0261
531.9	0.0239
584.8	0.0210
CURVE 5	
112.1	0.0138
116.8	0.0139
328.9	0.0214
389.1	0.0301
446.4	0.0301
456.6	0.0282
487.8	0.0278
537.6	0.0279
546.4	0.0287
588.2	0.0263
CURVE 6	
79.9	0.00870
194.9	0.0102
257.7	0.0115
275.5	0.0119
310.6	0.0146
332.2	0.0164
348.4	0.0189*
373.1	0.0214
393.7	0.0255
395.3	0.0260
CURVE 7	
315	0.0265
334	0.0223
354	0.0194
374	0.0187
404	0.0216
412	0.0231
438	0.0280
451	0.0303

* Not shown on plot

SPECIFICATION TABLE NO. 389 THERMAL CONDUCTIVITY OF Ag_xTe_y INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	552	L	1961	298.2		$Ag_{2-x}Te$	p-type hexagonal crystal by increasing the tellurium content to about 3 atomic % excess; specimen prepared by 99.999+ pure silver and 99.999+ pure tellurium reacted and either zone leveled or zone fined in carbon boat in vacuo; measured at room temperature vs. the electric conductivity σ.
2	552	L	1961	298.2		Ag_2Te	Intrinsic and n-type crystal; prepared by 99.999+ pure silver and 99.999+ pure tellurium reacted and either zone leveled or zone fined in carbon boat in vacuo; measured at room temperature vs. the electric conductivity σ.
3	552	L	1961	298.2		Ag_2Te	The above specimen doped with AgI of the order of 10^{19} atom/cc resulting excess silver of the order of 0.5 atomic % in Ag_2Te, measured at room temperature vs. electric conductivity σ.

DATA TABLE NO. 389 THERMAL CONDUCTIVITY OF Ag_xTe_y INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

$\sigma (ohm\ cm)^{-1}$	k
CURVE 1*	
T = 298.2	
140	0.0079
202	0.00815
CURVE 2*	
T = 298.2	
258	0.0081
274	0.0065
298	0.00809
720	0.0125
1050	0.0165
1370	0.01723
1400	0.0182
1497	0.0164
CURVE 3*	
T = 298.2	
537	0.0125
1247	0.0159
1495	0.0192
1766	0.0172

* No graphical presentation

SPECIFICATION TABLE NO. 390 THERMAL CONDUCTIVITY OF Sr_2Si INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	548	L	1961	298.2		Sr_2Si; No. 1	Synthesized; seebeck coeff. 21.1 $\mu v K^{-1}$ at 25 C; electrical resistivity 2.42 x 10^{-3} ohm cm at 25 C; figure of merit 0.289 x $10^{-4} K^{-1}$ at 25 C.

DATA TABLE NO. 390 THERMAL CONDUCTIVITY OF Sr_2Si INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.00636

* No graphical presentation

SPECIFICATION TABLE NO. 391 THERMAL CONDUCTIVITY OF Sr_2Sn INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	548	L	1961	298.2		Sr_2Sn; No. 1	Synthesized; seebeck coeff. 24.4 $\mu v K^{-1}$ at 25 C; electrical resistivity 3.5×10^{-4} ohm cm at 25 C; figure of merit $0.692 \times 10^{-4} K^{-1}$ at 25 C.

DATA TABLE NO. 391 THERMAL CONDUCTIVITY OF Sr_2Sn INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.0238

* No graphical presentation

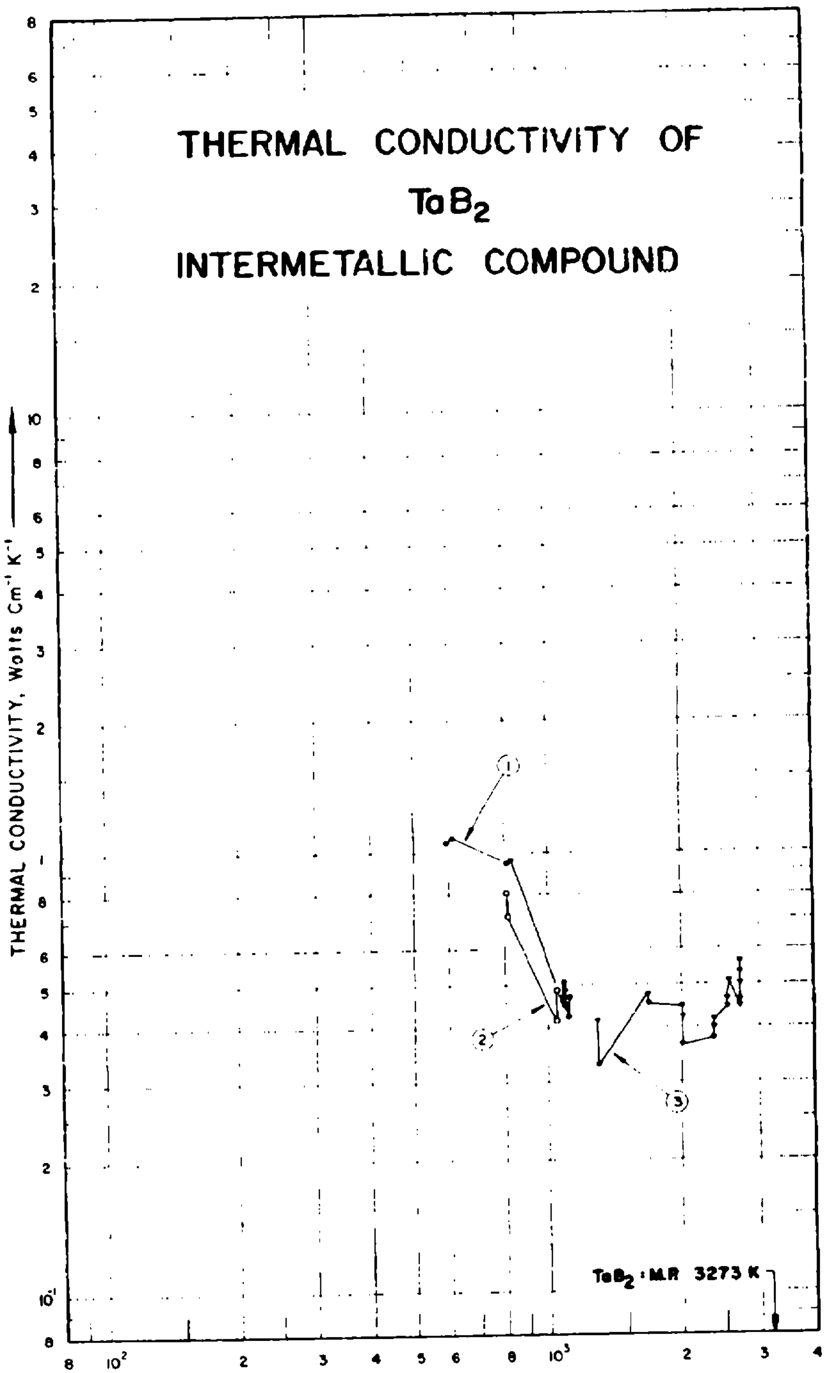

THERMAL CONDUCTIVITY OF
TaB2
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
TaB2 : M.P. 3273 K
1
2
3

FIG 392

SPECIFICATION TABLE NO. 392 THERMAL CONDUCTIVITY OF TaB_2 INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 392]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	603	R	1962	595-1174	6.5	TaB_2	Specimen 3/4 in. in dia and 3/4 in. long; pressed and sintered; maximum exposure temperature 2816 K; density 12.11 g cm^{-3}.
2	603	R	1962	810-1059	6.5	TaB_2	Similar to the above specimen.
3	603	R	1962	1300-2750	6.5	TaB_2	Similar to the above specimen except specimen found to show incipient melting after measurements.

DATA TABLE NO. 302 THERMAL CONDUCTIVITY OF TaB_2 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
594.8	1.06
603.2	1.07*
615.4	1.08
817.6	0.943
836.5	0.961
840.9	0.966*
1084.3	0.460
1090.4	0.509
1092.1	0.490
1092.6	0.450
1113.7	0.425
1174.3	0.470
CURVE 2	
810.4	0.803
813.2	0.896*
813.7	0.718
1054.8	0.415
1058.7	0.487
CURVE 3	
1299.8	0.414
1305.4	0.327
1306.2	0.330*
1683.2	0.476
1688.7	0.453
2011.0	0.446
2011.0	0.421
2011.0	0.363
2369.3	0.376
2369.3	0.400
2372.1	0.418
2558.2	0.444
2558.2	0.464
2563.7	0.505
2733.2	0.447
2738.7	0.462
2741.5	0.500
2747.1	0.532
2749.8	0.562

* Not shown on plot

SPECIFICATION TABLE NO. 393 THERMAL CONDUCTIVITY OF $TaGe_2$ INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	360		1961	303.2		$TaGe_2$	Electrical resistivity 6.5×10^{-4} ohm cm.

DATA TABLE NO. 393 THERMAL CONDUCTIVITY OF $TaGe_2$ INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
303.2	0.043

* No graphical presentation

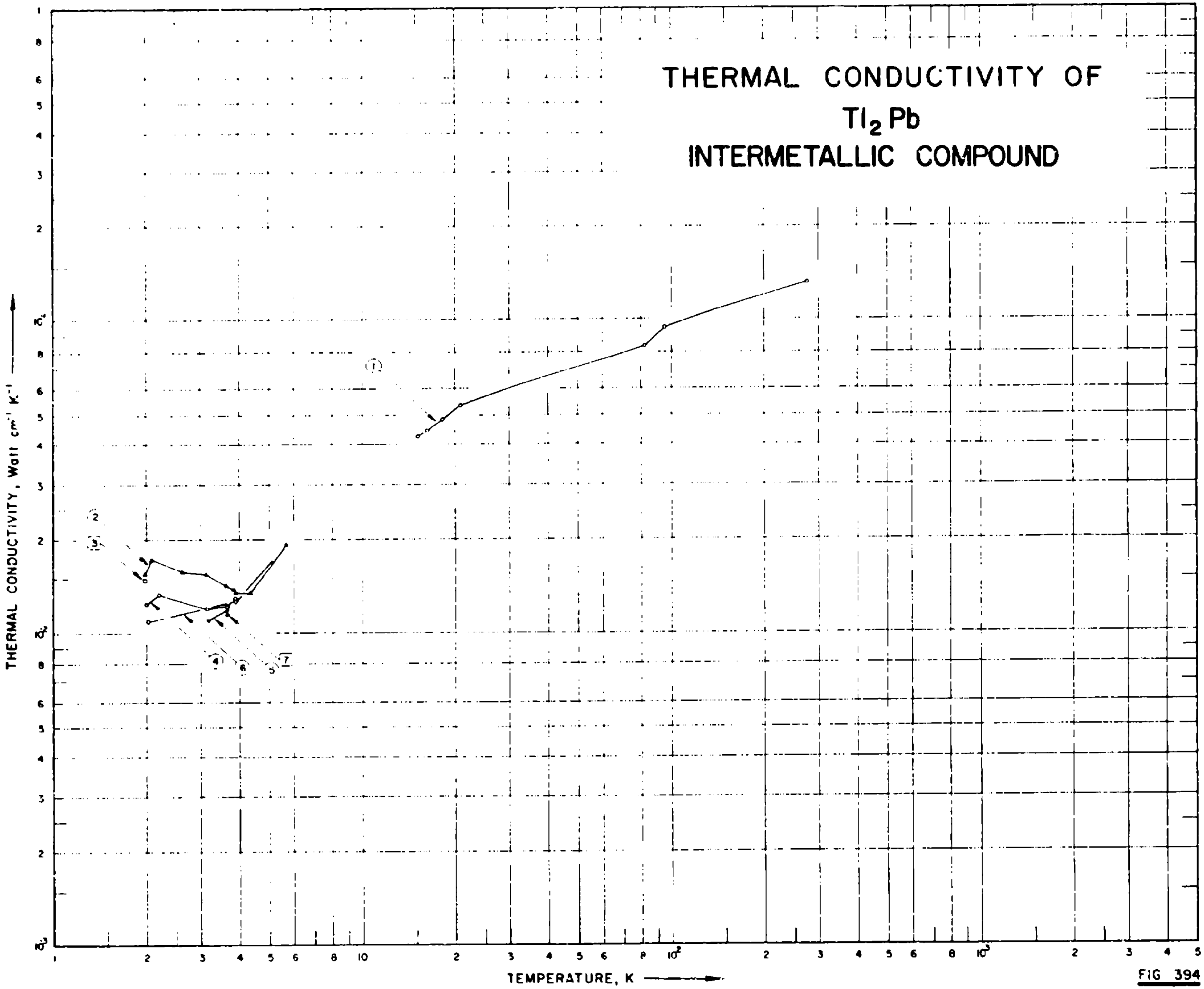

THERMAL CONDUCTIVITY OF
Tl_2Pb
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
4
5
6
7

FIG 394

SPECIFICATION TABLE NO. 394 THERMAL CONDUCTIVITY OF Tl_2Pb INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 394]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Tl	Pb	Composition (continued), Specifications and Remarks
1	337	L	1932	15-276		Tl_2Pb	66.3	33.7	Specimen 9 mm long, 7.4 mm dia; annealed for 180 hrs at ~ melting point.
2	337	L	1932	2.0-5.7		Tl_2Pb	66.3	33.7	The above specimen in superconducting state.
3	337	L	1932	1.97		Tl_2Pb	66.3	33.7	The above specimen measured in a 214 gauss magnetic field.
4	337	L	1932	2.0-3.9		Tl_2Pb	66.3	33.7	The above specimen measured in a 481 gauss magnetic field.
5	337	L	1932	3.2,3.7		Tl_2Pb	66.3	33.7	The above specimen measured in a 642 gauss magnetic field.
6	337	L	1932	2.0-5.7		Tl_2Pb	66.3	33.7	The above specimen measured in a 7[illegible]ss magnetic field.
7	337	L	1932	3.66		Tl_2Pb	66.3	33.7	The above specimen measured in a 835 gauss magnetic field.

DATA TABLE NO. 394 THERMAL CONDUCTIVITY OF Tl_2Pb INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
15.1	0.0423
16.2	0.0446
19.2	0.0487
20.9	0.0538
82	0.0936
95	0.0946
276	0.133
CURVE 2	
1.97	0.0156
2.17	0.0173
2.61	0.0158
3.12	0.0156
3.63	0.0143
3.84	0.0138
3.87	0.0136
4.34	0.0136
5.69	0.0193
CURVE 3	
1.97	0.0147
CURVE 4	
2.00	0.0124
2.21	0.0133
3.155	0.0120
3.65	0.0122
3.88	0.0129
CURVE 5	
3.17	0.0110
3.66	0.0119
CURVE 6	
2.02	0.0109
3.98	0.0127
5.69	0.0194

T	k
CURVE 7	
3.66	0.0116

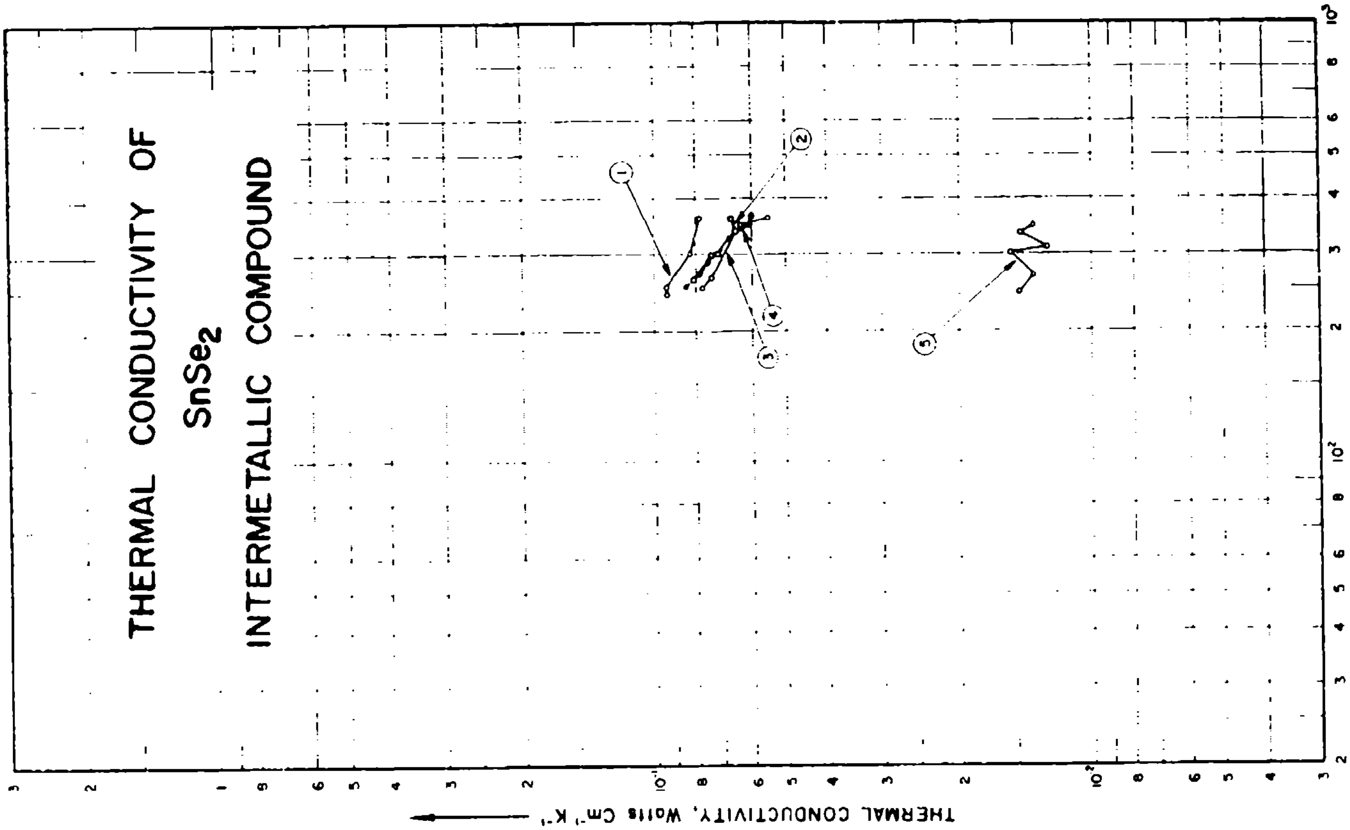

THERMAL CONDUCTIVITY OF
SnSe$_2$
INTERMETALLIC COMPOUND
1
2
3
4
5
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}

FIG 395

SPECIFICATION TABLE NO. 395 THERMAL CONDUCTIVITY OF $SnSe_2$ INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 395]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	545	L	1961	241-369	± 10	$Sn Se_2$	Polycrystal; n_s 2×10^{17} cm^{-3}; micro hardness 30 kg mm^{-2}; specimen 8 x 8 x 8 mm.
2	545	L	1961	261-359	± 10	$Sn Se_2$	Single crystal; prepared by the Bridgeman method from spectroscopically pure elements; specimen 8 x 8 x 8 mm; freezing point 629 ± 5 C; n_s · 2×10^{17} cm^{-3}; crystal structure, a 3.811 Å, c 6.137 Å; heat flow perpendicular to c-axis of crystal.
3	545	L	1961	249-360	± 10	$Sn Se_2$	Similar to the above specimen except n_s 6×10^{17} cm^{-3}.
4	545	L	1961	251-363	± 10	$Sn Se_2$	Similar to the above specimen.
5	545	L	1961	244-345	± 10	$Sn Se_2$	Similar to the above specimen except heat flow parallel to c-axis.

DATA TABLE NO. 395 THERMAL CONDUCTIVITY OF $SnSe_2$ INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
241.0	0.0934
250.9	0.0940
298.5	0.0823
360.4	0.0784
CURVE 2	
260.6	0.0810
296.3	0.0739
298.5	0.0711
336.1	0.0655
359.1	0.0669
CURVE 3	
249.1	0.0772
263.2	0.0739
347.8	0.0633
360.4	0.0550
CURVE 4	
250.6	0.0847
269.5	0.0784
284.9	0.0749
300.8	0.0711*
303.0	0.0701*
326.8	0.0659
347.9	0.0611
363.6	0.0600
CURVE 5	
243.9	0.0146
265.6	0.0136
298.5	0.0153
300.8	0.0126
333.3	0.0146
344.8	0.0136

* Not shown on plot

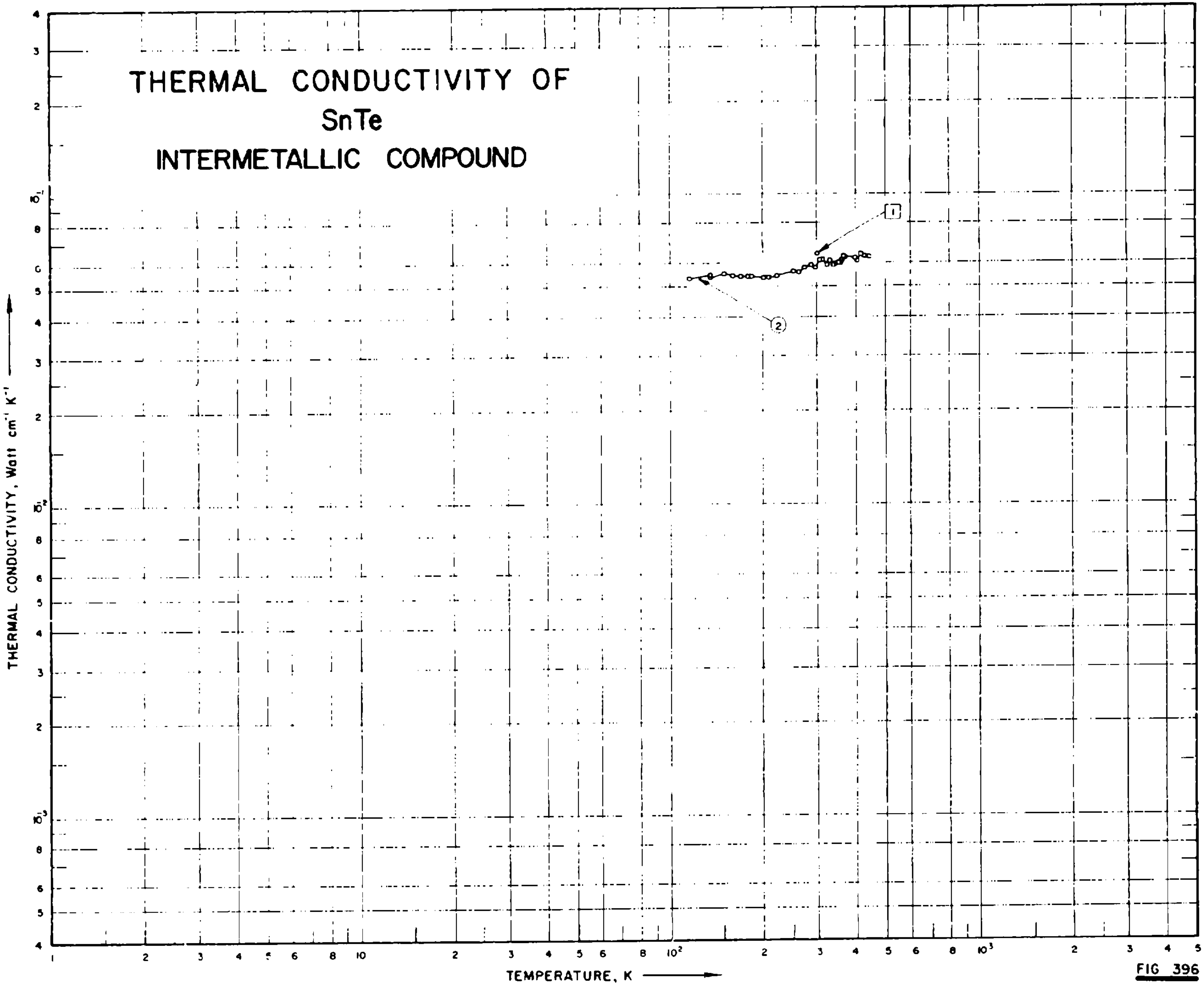

THERMAL CONDUCTIVITY OF
SnTe
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2

FIG 396

SPECIFICATION TABLE NO. 396 THERMAL CONDUCTIVITY OF SnTe INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 396]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	553	L	1959	300		SnTe	No information reported.
2	964	L	1966	116-440		SnTe	Stoichiometric single crystal; prepared by melting 99.999 pure Sn and Te in a 5 ~ 6 mm dia quartz phial (to which a 1 mm dia x 14 mm long capillary was attached) in a vacuum of 10^{-2} Torr, heated at 100 C higher than the melting point for 100 hrs, pulling-processed through a double melting oven (upper oven 30 ~ 50 C above, and the lower oven 30 ~ 50 C below, the melting temperature) with a velocity 10 mm h^{-1}, annealed at 300 C for 4 ~ 6 hrs; electrical resistivity reported as 589 ~ 762 μ ohm cm in the range 85.2 ~ 483 K.

DATA TABLE NO. 396 THERMAL CONDUCTIVITY OF SnTe INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
300	0.065
CURVE 2	
116	0.0537
136	0.0548
136	0.0544
150	0.0552
160	0.0548
171	0.0545
179	0.0545
185	0.0543
202	0.0540
209	0.0540
223	0.0548
252	0.0566
264	0.0563
274	0.0561
289	0.0591
297	0.0582
306	0.0617
314	0.0619
324	0.0593
330	0.0611
338	0.0595
342	0.0600
351	0.0604
354	0.0604
360	0.0615
366	0.0631
370	0.0630
399	0.0624
406	0.0617
416	0.0641
426	0.0634
440	0.0635

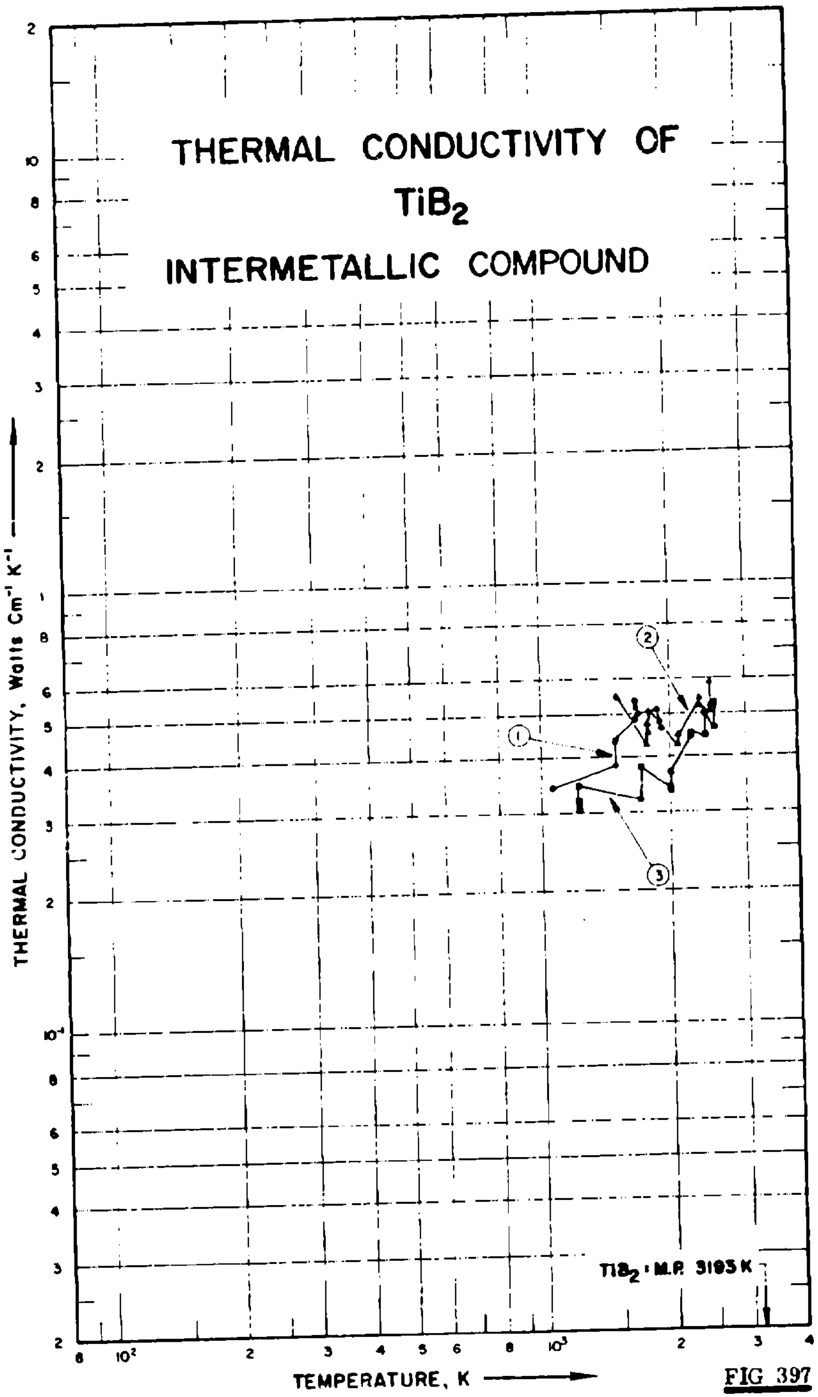

THERMAL CONDUCTIVITY OF
TiB_2
INTERMETALLIC COMPOUND
TiB_2 : M.P. 3193 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}

FIG 397

SPECIFICATION TABLE NO. 397 THERMAL CONDUCTIVITY OF TiB_2 INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 397]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	544	R	1963	1075-1937	5-7	TiB_2; 1	Specimen 3/4 in. long, 3/4 in. O.D. and 1/4 in. I.D.; ground and polished; specimen found cracked on post inspection, heat-soaked at 3800 F.
2	544	R	1963	1542-2516	5-7	TiB_2; 3	Similar to the above specimen except heat-soaked at 3509 F; specimen found cracked on the post inspection.
3	544	R	1963	1239-2578	5-7	TiB_2; 4	Similar to the above specimen.

DATA TABLE NO. 397 THERMAL CONDUCTIVITY OF TiB_2 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
1074.8	0.341
1596.5	0.381
1596.5	0.432
1527.1	0.438
1594.3	0.486
1695.9	0.537
1703.2	0.530
1890.4	0.511
1910.9	0.480
1937.1	0.463
CURVE 2	
1541.5	0.544
1544.3	0.546
1545.4	0.541
1793.2	0.424
1797.1	0.476
1798.7	0.453
1803.7	0.507
2103.7	0.424
2109.8	0.423*
2110.9	0.447
2370.4	0.544
2372.6	0.522
2504.3	0.506
2511.5	0.526
2515.9	0.590
CURVE 3	
1238.7	0.306
1238.7	0.316
1238.7	0.319
1239.8	0.345
1720.4	0.320
1720.4	0.320*
1724.3	0.376
2019.3	0.340
2024.3	0.335
2024.3	0.369
2262.1	0.446
2262.1	0.453
2263.2	0.448*
CURVE 3 (cont.)	
2456.5	0.447
2456.5	0.504
2569.3	0.466
2570.4	0.468*
2577.6	0.530

* Not shown on plot

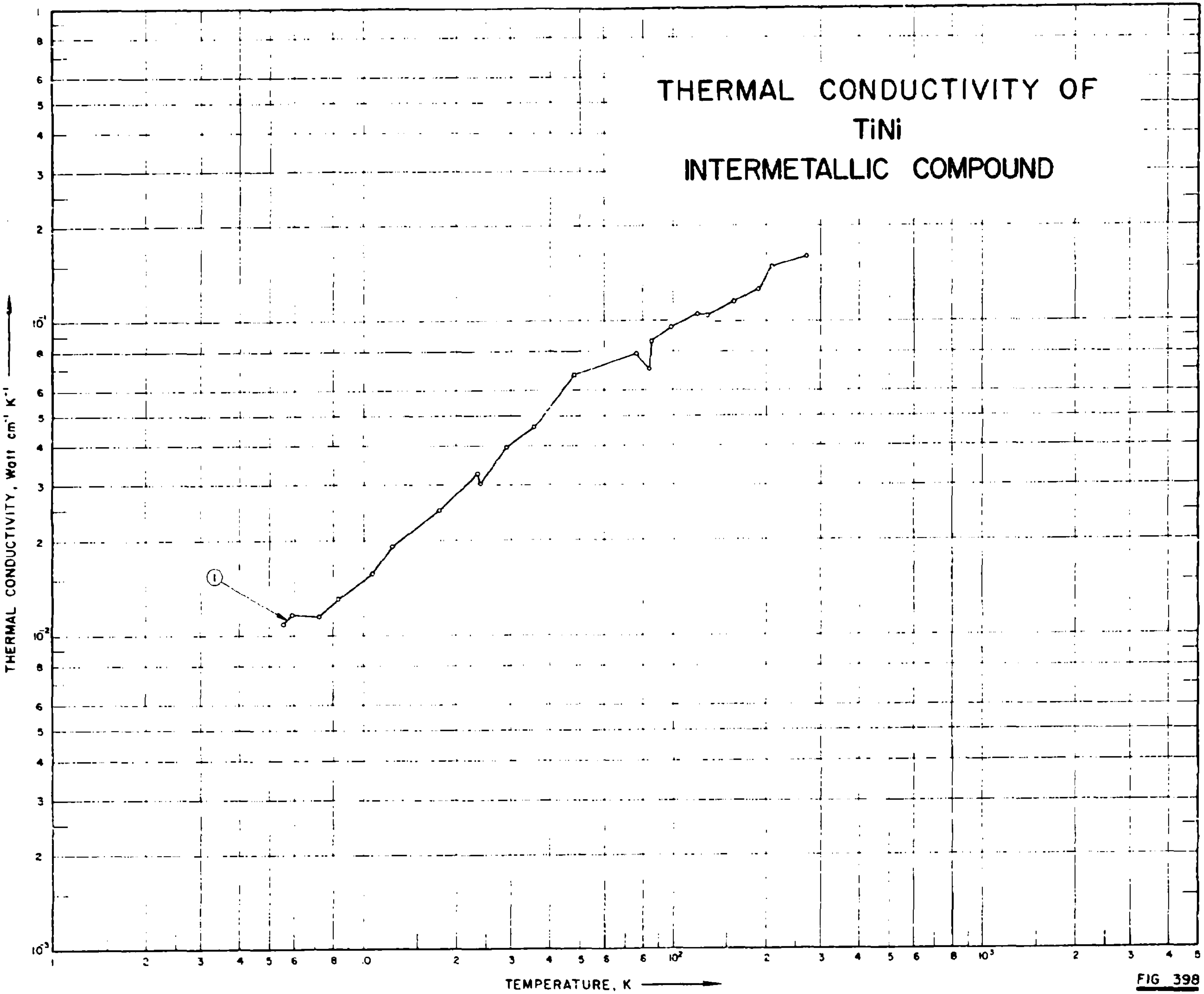

THERMAL CONDUCTIVITY OF
TiNi
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1

FIG 398

SPECIFICATION TABLE NO. 398 THERMAL CONDUCTIVITY OF TiNi INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 398]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	965	L	1964	5.5 – 272	5	TiNi	Stoichiometric; prepared from Monel nickel shot (99.9+ pure) and DuPont high purity sponge, the titanium contained up to: 0.08 Mg, 0.07 Fe, 0.05 Mn, 0.04 Si, and 0.15 other impurities; specimen rod was hot swagged and furnace cooled from homogenized buttons and machined into cylinder of 0.4 cm dia x 3 cm long; grain size ~42 μ; electrical resistivity reported range from 23.0 ~ 66.8 μ ohm cm at 1.32 ~ 302.7 K, respectively.

DATA TABLE NO. 398 THERMAL CONDUCTIVITY OF TiNi INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
5.53	0.0109
5.97	0.0117
7.26	0.0116
8.34	0.0131
10.7	0.0157
12.5	0.0192
17.7	0.0249
22.5	0.0327
23.8	0.0302
29.2	0.0397
35.6	0.0462
48.2	0.0671
76.4	0.0748
84.0	0.0703
85.5	0.0877
99.1	0.0964
121.6	0.106
130.0	0.105
158.1	0.116
190.4	0.127
210.4	0.151
271.6	0.163

SPECIFICATION TABLE NO. 399 THERMAL CONDUCTIVITY OF W_3As_7 INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	960		1961	303.2		W_3As_7	Electrical resistivity 2.6 x 10^{-4} ohm cm at 30 C.

DATA TABLE NO. 399 THERMAL CONDUCTIVITY OF W_3As_7 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
303.2	0.032

* No graphical presentation

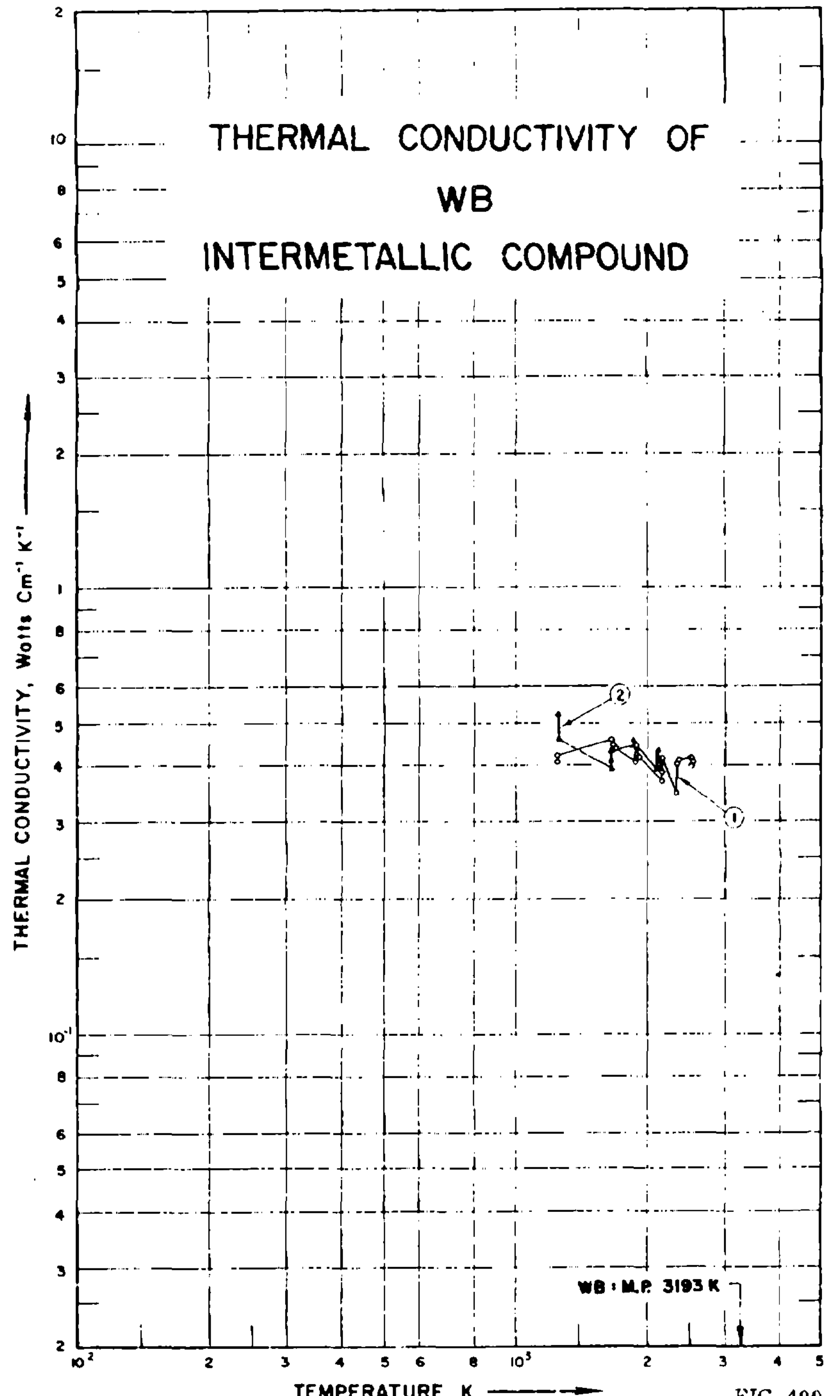

THERMAL CONDUCTIVITY OF
WB
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
WB : M.P. 3193 K
1
2

FIG 400

SPECIFICATION TABLE NO. 400 THERMAL CONDUCTIVITY OF WB INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 400]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	544	R	1963	1255-2540	5-7	WB, 1	Specimen 3/4 in. long, 3/4 in. O.D. and 1/4 I.D.; ground and polished; specimen found broken on post inspection; heat-soaked at 3300 F.
2	544	R	1963	1253-2150	5-7	WB, 2	Similar to the above specimen except heat-soaked at 3350 F; specimen found cracked on post inspection.

DATA TABLE NO. 400 THERMAL CONDUCTIVITY OF WB INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k
CURVE 1	
1255.4	0.426*
1255.4	0.410
1255.4	0.426
1654.8	0.460
1674.8	0.448
1687.1	0.441
1896.5	0.409
1899.3	0.448
1905.4	0.416
2162.1	0.369
2162.6	0.370
2166.5	0.387
2172.1	0.418
2344.3	0.348
2349.3	0.403
2355.4	0.413
2526.5	0.420
2529.3	0.398
2540.4	0.412
CURVE 2	
1252.6	0.526
1252.6	0.461
1252.6	0.462*
1658.7	0.395
1659.3	0.410
1660.9	0.433
1887.1	0.442
1887.6	0.458
1888.7	0.451
1888.7	0.453
2132.6	0.393
2137.1	0.436
2150.4	0.389

*Not shown on plot

SPECIFICATION TABLE NO. 401 THERMAL CONDUCTIVITY OF WSe_2 INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	960		1961	303.2		WSe_2	Electrical resistivity 95 ohm cm at 30 C.

DATA TABLE NO. 401 THERMAL CONDUCTIVITY OF WSe_2 INTERMETALLIC COMPOUNDS

(Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$)

T	k
CURVE 1*	
303.2	0.034

* No graphical presentation

SPECIFICATION TABLE NO. 402 THERMAL CONDUCTIVITY OF WSi_2 INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	594	R	1961	733-1793		WSi_2	No details reported.

DATA TABLE NO. 402 THERMAL CONDUCTIVITY OF WSi_2 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1} K^{-1}]

T	k	T	k
CURVE 1*		CURVE 1 (cont.)*	
733.2	0.393	1789.3	0.391
735.4	0.393	1790.9	0.386
749.8	0.381	1792.6	0.400
753.2	0.374		
874.8	0.339		
883.2	0.343		
883.2	0.348		
895.4	0.337		
895.4	0.336		
1038.7	0.310		
1041.5	0.312		
1210.9	0.294		
1211.5	0.299		
1368.7	0.305		
1373.2	0.299		
1473.2	0.318		
1481.5	0.322		
1537.1	0.296		
1539.6	0.308		
1645.4	0.325		
1654.3	0.327		
1717.6	0.313		
1720.4	0.315		
1766.5	0.367		

* No graphical presentation

SPECIFICATION TABLE NO. 403 THERMAL CONDUCTIVITY OF WTe_2 INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	960		1961	303.2		WTe_2	Electrical resistivity 3.5×10^{-2} ohm cm at 30 C.

DATA TABLE NO. 403 THERMAL CONDUCTIVITY OF WTe_2 INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
303.2	0.020

* No graphical presentation

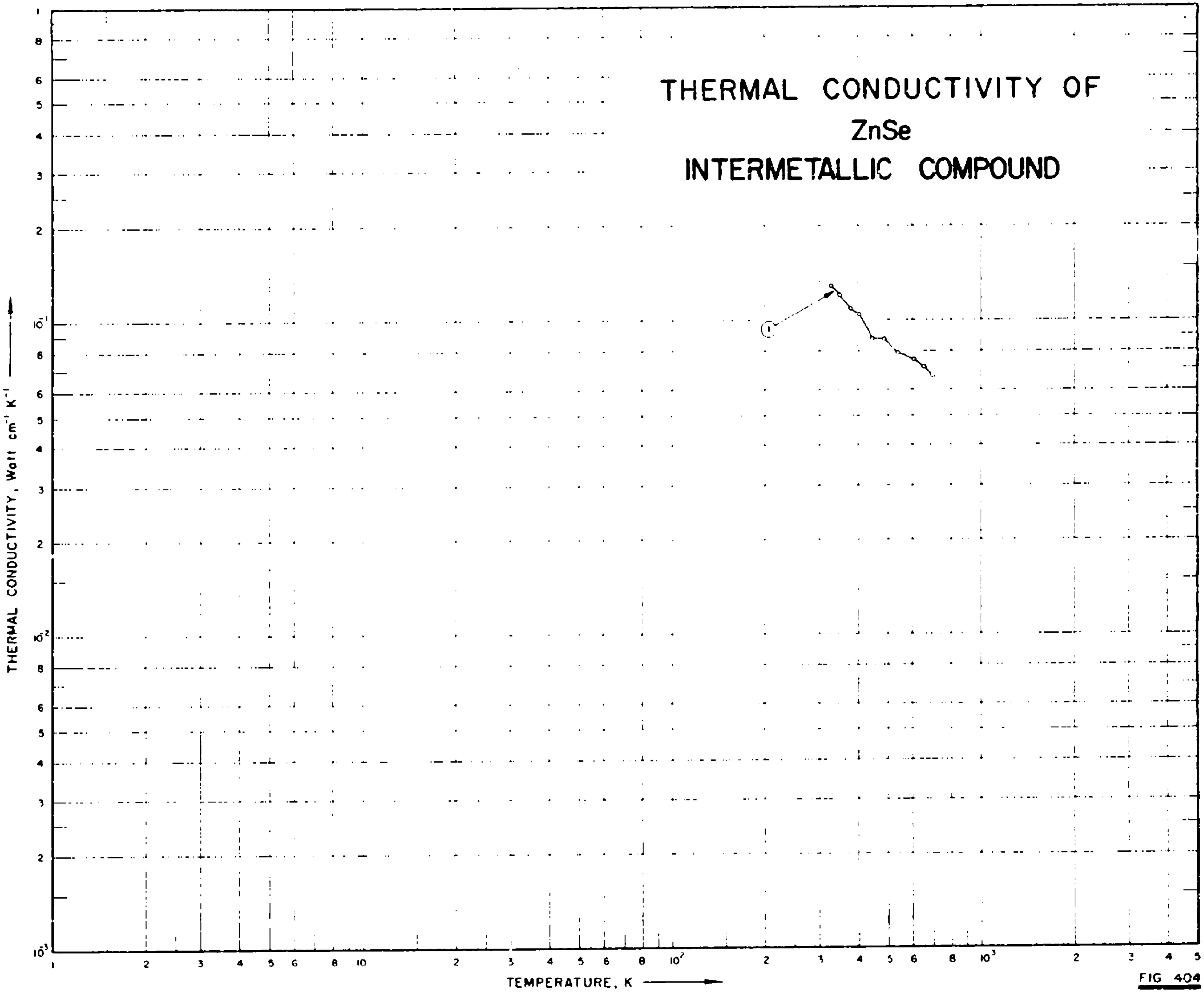

THERMAL CONDUCTIVITY OF
ZnSe
INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1

FIG 404

SPECIFICATION TABLE NO. 404 THERMAL CONDUCTIVITY OF ZnSe INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 404]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	966		1963	327-695		ZnSe	Hot-pressed; density 5.267 g cm^{-3}.

DATA TABLE NO. 404 THERMAL CONDUCTIVITY OF ZnSe INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
327.2	0.130
348.2	0.121
376.2	0.109
402.2	0.105
444.2	0.0879
489.2	0.0879
536.2	0.0795
572.2	0.0795
608.2	0.0753
650.2	0.0711
695.2	0.0669

SPECIFICATION TABLE NO. 405 THERMAL CONDUCTIVITY OF $ZnSiAs_2$ INTERMETALLIC COMPOUNDS

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	967	L	1966	298.2		$ZnSiAs_2$: 5	Stoichiometric p-type polycrystalline; 12 x 4 x 4 mm; prepared by melting appropriate amounts of 99.9998 pure Zn, p-type Si (~ 500 ohm cm), and 99.999 pure As in a carbon coated fused quartz tube which was filled with argon at 1 atm, heated at 75 C hr^{-1} until specimen completely molten, annealed at ~ 1136 C for 1 hr, vibrated at 100 cps from about 400 C to the maximum temperature to remove blow holes and voids and insure complete mixing, then the Bridgman process was performed at a lowering rate of 3 mm hr^{-1} until room temperature reached; melting temperature 1096 C; electrical resistivity 4.5 x 10^2 ohm cm at room temperature.

DATA TABLE NO. 405 THERMAL CONDUCTIVITY OF $ZnSiAs_2$ INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.14

* No graphical presentation

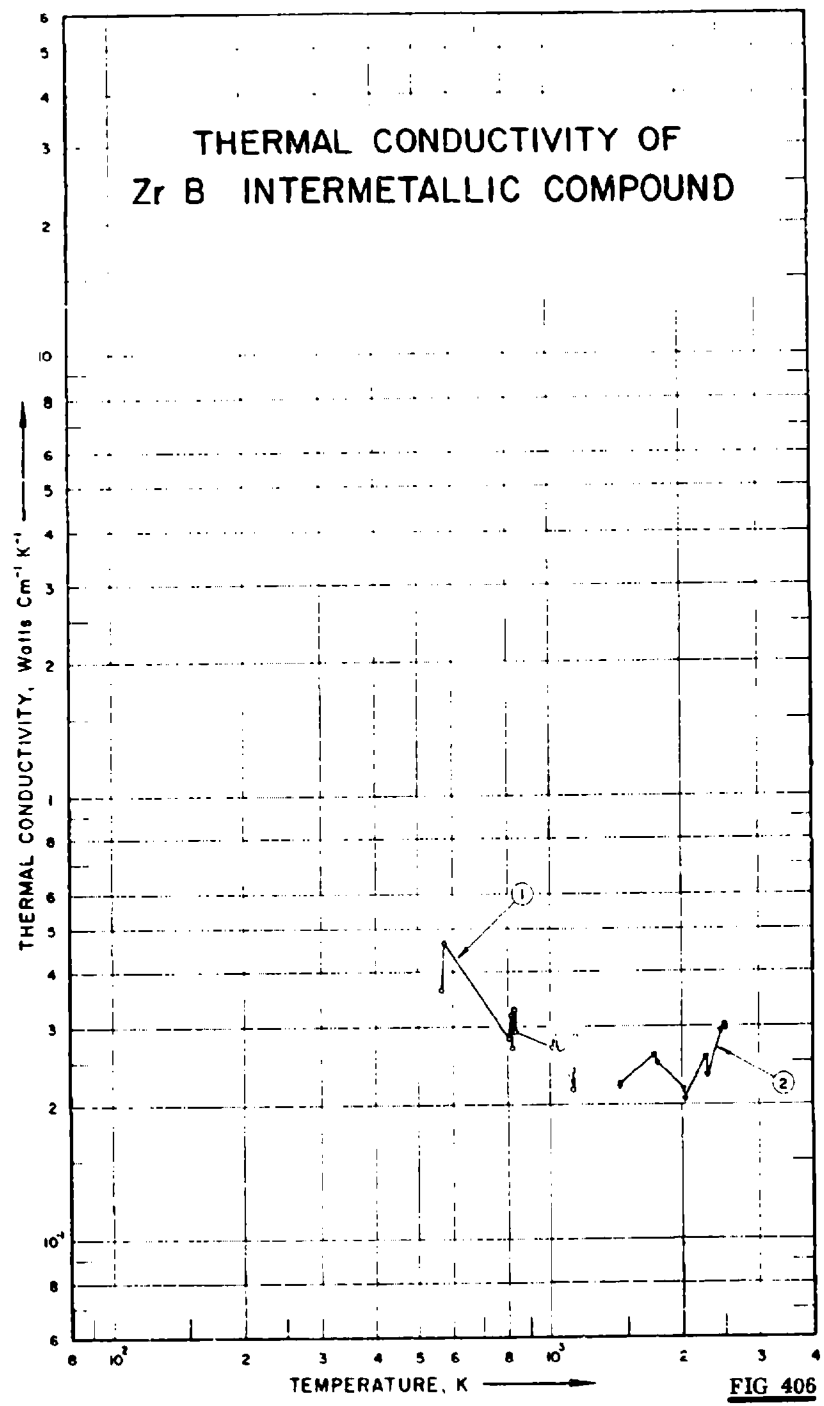

THERMAL CONDUCTIVITY OF
Zr B INTERMETALLIC COMPOUND
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹
TEMPERATURE, K
1
2

FIG 406

SPECIFICATION TABLE NO. 406 THERMAL CONDUCTIVITY OF ZrB INTERMETALLIC COMPOUNDS

[For Data Reported in Figure and Table No. 406]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	603	R	1962	568-1134	3	Zr B; C-52	78.7 Zr, 17.6 B, and 0.30 C, balance Ti, Fe, Ni, Ca, Al, and Si; specimen composed of Zr B plus Zr B_2; dimensions 0.75 in. O.D., 0.25 in. I.D., 0.75 in. long; supplied by Norton Company; hot pressed; density 4.13 g cm^{-3} (70-75% of theoretical density).
2	603	R	1962	1442-2528	3	Zr B; C-60	Similar to the above specimen except found melted after test.

DATA TABLE NO. 406 THERMAL CONDUCTIVITY OF ZrB INTERMETALLIC COMPOUNDS

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
567.6	0.365
575.4	0.467
805.9	0.283
811.5	0.315
818.7	0.268
822.1	0.326
824.3	0.294
1012.1	0.270
1025.4	0.294
1035.9	0.264
1107.1	0.274
1116.5	0.232
1126.5	0.216
1134.3	0.257
CURVE 2	
1441.5	0.219
1444.3	0.224
1727.6	0.257
1731.8	0.255*
1766.5	0.247
2038.7	0.216
2038.7	0.212*
2035.7	0.205
2272.1	0.255
2274.8	0.231
2466.5	0.294
2516.5	0.304
2527.6	0.296

* Not shown on plot

SPECIFICATION TABLE NO. 407 THERMAL CONDUCTIVITY OF (Sb_2Se_3 + Ag_2Se + PbSe) MIXTURES

(Sb_2Se_3 + Ag_2Se + PbSe > 95.0%; impurity < 2.0% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	971		1962	298.2		$Ag_6Sb_6PbSe_{13}$	55.19 Sb_2Se_3, 33.85 Ag_2Se, and 10.96 PbSe; p-type; specimen obtained by fusing ASARCO 99.999 pure elements in carbon coated quartz tube with agitation, cooling, crushing, recasting in 8 mm uncoated quartz, and zone-leveling; electrical resistivity 0.21 ohm cm, (measuring temperature assumed 25 C).

DATA TABLE NO. 407 THERMAL CONDUCTIVITY OF (Sb_2Se_3 + Ag_2Se + PbSe) MIXTURES

(Sb_2Se_3 + Ag_2Se + PbSe > 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.0058

* No graphical presentation

FIGURE SHOWS ONLY 22 OF THE CURVES REPORTED IN TABLE

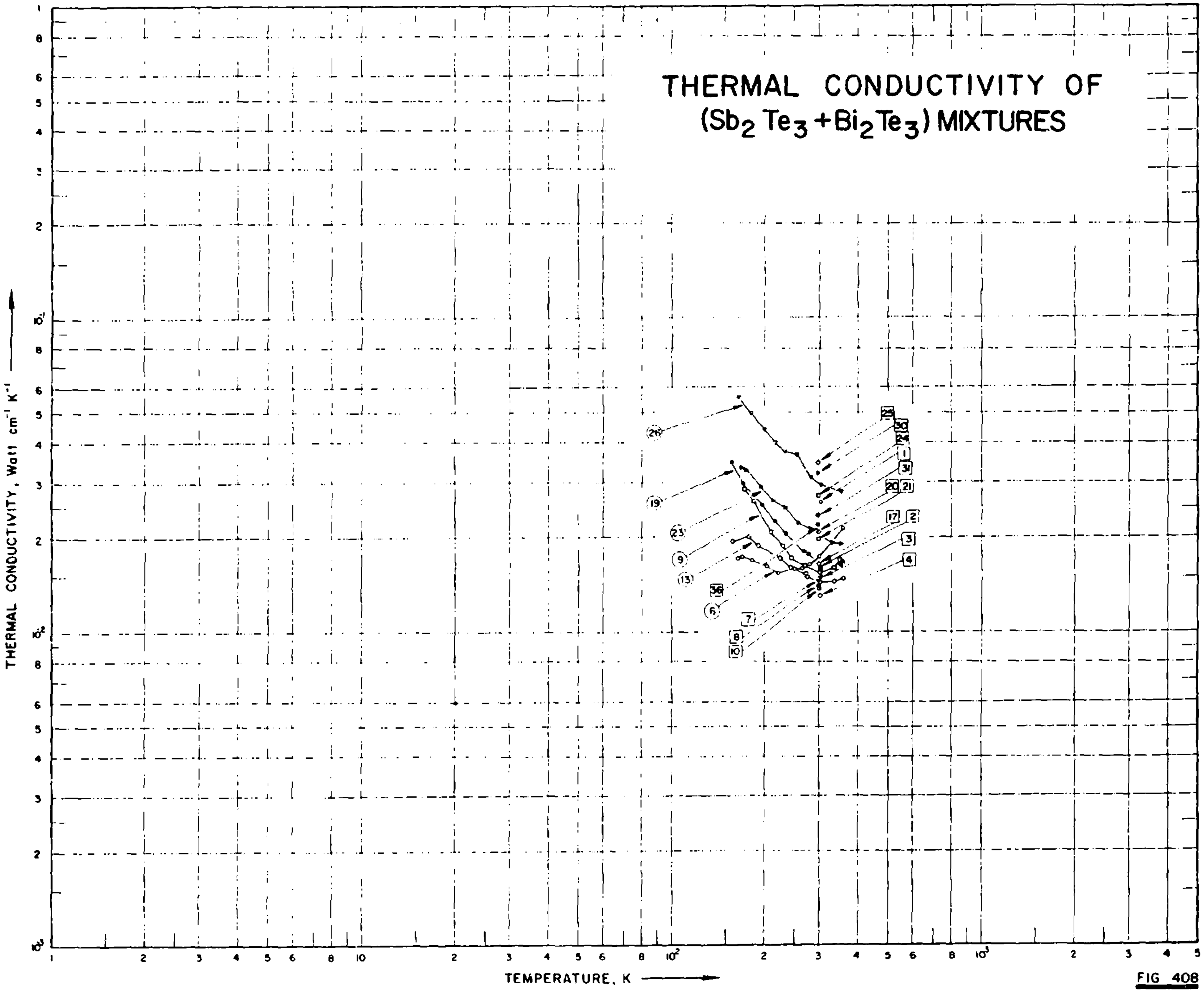


FIG 408

SPECIFICATION TABLE NO. 408 THERMAL CONDUCTIVITY OF (Sb_2Te_3 + Bi_2Te_3) MIXTURES

(Sb_2Te_3 + Bi_2Te_3) > 95.0%; impurity < 2.0% each)

[For Data Reported in Figure and Table No. 408]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb_2Te_3	Bi_2Te_3	Composition (continued), Specifications and Remarks
1	832		1962	303.2		$Sb_{1.8}Bi_{0.2}Te_3$	87.6	12.4	p-type; prepared by using the powder metallurgical techniques, pressed and sintered; heat flow perpendicular to the pressing direction.
2	832		1962	303.2		$Sb_{1.7}Bi_{0.3}Te_3$	80.1	19.9	Similar to the above specimen.
3	332		1962	303.2		$Sb_{1.6}Bi_{0.4}Te_3$	75.8	24.2	Similar to the above specimen.
4	832		1962	303.2		$Sb_{1.5}Bi_{0.5}Te_3$	70.1	29.9	Similar to the above specimen.
5	936	T	1965	298.2		$Sb_{1.2}Bi_{0.8}Te_{3.13}$	52.73	44.94	2.33 Te (calculated) p-type; specimen size 0.5 x 0.5 x 1 cm; prepared from 99.999 pure Bi and Sb supplied by consolidated Mining and Smelting Co., and from 99.97 pure Te supplied by Canadian Copper Refiners Ltd., materials weighed out, crushed, sealed in an ampule in a vacuum of 10^{-5} Torr, heated at 900 C for 20 hrs, rocked, cooled, then zone-melted at a rate of 0.07 ~0.28 in. hr^{-1}, cooled and cut; thermal conductivity data calculated from measured values of figure of merit, Seebeck coefficient, and electrical conductivity; electrical conductivity reported as 0.83 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
6	936	T	1965	164-357		$Sb_{1.2}Bi_{0.8}Te_{3.13}$	52.73	44.94	p-type; same fabrication method and measuring method as 2.33 Te (calculated); the above specimen; electrical resistivity reported as 0.116, 0.121, 0.135, 0.156, 0.185, 0.225, 0.259, 0.284, 0.315, 0.352, and 0.356 milliohm cm at 166, 172, 185, 203, 221, 245, 267, 282, 301, 333, and 357 K, respectively.
7	936	T	1965	298.2		$Sb_{1.33}Bi_{0.67}Te_{3.13}$	59.56	38.07	2.37 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 0.77 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
8	936	T	1965	298.2		$Sb_{1.33}Bi_{0.67}Te_{3.13}$			Cut from the same ingot as the above specimen; electrical conductivity reported on 0.69 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
9	936	T	1965	172-351		$Sb_{1.33}Bi_{0.67}Te_{3.13}$			Same composition, fabrication method, and measuring method as the above specimen; electrical resistivity 0.472, 0.509, 0.661, 0.791, 0.910, 1.10, 1.41, 1.76, 1.95, and 2.04 milliohm cm at 173, 185, 212, 232, 248, 269, 301, 335, 351, and 369 K, respectively.
10	936	T	1965	298.2		$Sb_{1.4}Bi_{0.6}Te_{3.13}$	63.06	34.55	2.39 Te (calculated); p-type; some fabrication method and measuring method as the above specimen; electrical conductivity reported as 0.83 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.

SPECIFICATION TABLE NO. 403 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb_2Te_3	Bi_2Te_3	Composition (continued), Specifications and Remarks
11	936	T	1965	298.2		$Sb_{1.4}Bi_{0.6}Te_{3.13}$			Cut from the same ingot as the above specimen; electrical conductivity reported as 0.89 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
12	936	T	1965	298.2		$Sb_{1.4}Bi_{0.6}Te_{3.13}$			Similar to the above specimen except electrical conductivity reported as 0.87 x10^3 $ohm^{-1}cm^{-1}$ at room temperature.
13	936	T	1965	158-360		$Sb_{1.4}Bi_{0.6}Te_{3.13}$			Similar to the above specimen except electrical resistivity reported as 0.354, 0.408, 0.467, 0.637, 0.776, 0.917, 1.17, 1.45, and 1.65 milliohm cm at 159, 178, 192, 224, 251, 273, 305, 337, and 357 K, respectively.
14	936	T	1965	298.2		$Sb_{1.5}Bi_{0.5}Te_{3.13}$	68.42	29.16	2.42 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.13 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
15	936	T	1965	298.2		$Sb_{1.5}Bi_{0.5}Te_{3.13}$			Another run of the above specimen; electrical conductivity reported as 1.39 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
16	936	T	1965	298.2		$Sb_{1.5}Bi_{0.5}Te_{3.13}$	68.42	29.16	2.42 Te (calculated); cut from the same ingot as the above specimen; electrical conductivity reported as 1.18 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
17	936	T	1965	298.2		$Sb_{1.5}Bi_{0.5}Te_{3.13}$	68.42	29.16	2.42 Te (calculated); similar to the above specimen except electrical conductivity reported as 1.22 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
18	936	T	1965	298.2		$Sb_{1.5}Bi_{0.5}Te_{3.13}$			Similar to the above specimen except electrical conductivity reported as 1.17 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
19	936	T	1965	158-358		$Sb_{1.5}Bi_{0.}Te$	68.42	29.16	2.42 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical resistivity reported as 0.269, 0.306, 0.376, 0.461, 0.539, 0.689, 0.746, 0.859, 1.00, and 1.19 milliohm cm at 159, 173, 197, 219, 237, 269, 281, 301, 329, and 352 K, respectively.
20	936	T	1965	298.2		$Sb_{1.6}Bi_{0.4}Te_{3.11}$	73.92	23.63	2.45 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.73 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.

SPECIFICATION TABLE NO. 408 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb_2Te_3	Bi_2Te_3	Composition (continued), Specifications and Remarks
21	936	T	1965	298.2		$Sb_{1.6}Bi_{0.4}Te_{3.13}$	73.92	23.63	2.45 Te (calculated); cut from the same ingot as the above specimen; electrical conductivity reported as 1.92×10^3 ohm^{-1} cm^{-1} at room temperature.
22	936	T	1965	298.2		$Sb_{1.6}Bi_{0.4}Te_{3.13}$	73.92	23.63	2.45 Te (calculated); similar to the above specimen except electrical conductivity reported as 1.82×10^3 ohm^{-1} cm^{-1} at room temperature.
23	936	T	1965	168-353		$Sb_{1.6}Bi_{0.4}Te_{3.13}$	73.92	23.63	2.45 Te (calculated); similar to the above specimen except electrical resistivity reported as 0.210, 0.220, 0.255, 0.293, 0.337, 0.400, 0.462, 0.513, 0.618, and 0.692 milliohm cm at 169, 176, 195, 213, 232, 256, 282, 300, 335, and 354 K, respectively.
24	936	T	1965	298.2		$Sb_{1.8}Bi_{0.2}Te_{3.13}$	85.36	12.13	2.51 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 2.44×10^3 ohm^{-1} cm^{-1} at room temperature.
25	936	T	1965	298.2		$Sb_{1.8}Bi_{0.2}Te_{3.13}$			Cut from the same ingot as the above specimen; electrical conductivity reported as 3.12×10^3 ohm^{-1} cm^{-1} at room temperature.
26	936	T	1965	167-356		$Sb_{1.8}Bi_{0.2}Te_{3.13}$			Similar to the above specimen; electrical resistivity reported as 0.136, 0.150, 0.168, 0.188, 0.207, 0.229, 0.272, 0.304, 0.356, and 0.388 milliohm cm at 168, 183, 200, 217, 233, 255, 284, 304, 337, and 354 K, respectively.
27	936	T	1965	298.2		$Sb_{1.4}Bi_{0.6}Te_{3.06}$	63.88	35.00	1.12 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.15×10^3 ohm^{-1} cm^{-1} at room temperature.
28	936	T	1965	298.2		$Sb_{1.4}Bi_{0.6}Te_{3.19}$	62.37	34.18	3.45 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 0.85×10^3 ohm^{-1} cm^{-1} at room temperature.

SPECIFICATION TABLE NO. 408 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Sb_2Te_3	Bi_2Te_3	Composition (continued), Specifications and Remarks
29	936	T	1965	298.2		$Sb_{1.4}Bi_{0.5}Te_{3.26}$	61.59	23.75	4.66 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 0.88×10^3 ohm^{-1} cm^{-1} at room temperature.
30	936	T	1965	298.2		$Sb_{1.5}Bi_{0.5}Te_3$	70.12	29.88	p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 3.22×10^3 ohm^{-1} cm^{-1} at room temperature.
31	936	T	1965	298.2		$Sb_{1.5}Bi_{0.5}Te_{3.06}$	69.32	29.55	1.13 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.72×10^3 ohm^{-1} cm^{-1} at room temperature.
32	936	T	1965	298.2		$Sb_{1.5}Bi_{0.5}Te_{3.19}$	67.67	28.84	3.49 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.24×10^3 $ohm^{-1}cm^{-1}$ at room temperature.
33	936	T	1965	298.2		$Sb_{1.5}Bi_{0.5}Te_{3.26}$	66.31	28.47	4.72 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.19×10^3 ohm^{-1} cm^{-1} at room temperature.
34	936	T	1965	298.2		$Sb_{1.6}Bi_{0.4}Te_{3.06}$	74.91	23.94	1.15 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.52×10^3 $ohm^{-1}cm^{-1}$ at room temperature.
35	936	T	1965	298.2		$Sb_{1.6}Bi_{0.4}Te_{3.19}$	73.10	23.36	3.54 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.74×10^3 $ohm^{-1}cm^{-1}$ at room temperature.
36	936	T	1965	298.2		$Sb_{1.6}Bi_{0.4}Te_{3.26}$	72.16	23.06	4.78 Te (calculated); p-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.78×10^3 $ohm^{-1}cm^{-1}$ at room temperature.

DATA TABLE NO. 408 THERMAL CONDUCTIVITY OF (Sb_2Te_3 + Bi_2Te_3) MIXTURES

(Sb_2Te_3 + Bi_2Te_3 > 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
303.2	0.026
CURVE 2	
303.2	0.016
CURVE 3	
303.2	0.015
CURVE 4	
303.2	0.013
CURVE 5*	
298.2	0.0182
CURVE 6	
164.2	0.0172
170.6	0.0174
183.8	0.0169
202.0	0.0162
221.2	0.0155
249.4	0.0160
264.6	0.0160
280.9	0.0165
301.2	0.0175
357.1	0.0212
CURVE 7	
298.2	0.0146
CURVE 8	
298.2	0.0141
CURVE 9	
172.1	0.0286
184.2	0.0261
211.9	0.0207
230.4	0.0187
246.9	0.0173
269.5	0.0163
301.2	0.0156
335.6	0.0161
350.9	0.0170
CURVE 10	
298.2	0.0137
CURVE 11*	
298.2	0.0145
CURVE 12*	
298.2	0.0141
CURVE 13	
157.7	0.0194
177.0	0.0200
191.2	0.0188
224.7	0.0173
243.9	0.0161
271.6	0.0154
275.5	0.0150
303.0	0.0144
336.7	0.0144
359.7	0.0148
CURVE 14*	
298.2	0.0147
CURVE 15*	
298.2	0.0178
CURVE 16*	
298.2	0.0158
CURVE 17	
298.2	0.0166
CURVE 18*	
298.2	0.0156
CURVE 19	
157.7	0.0348
171.8	0.0298
196.1	0.0255
217.9	0.0226
235.9	0.0205
268.8	0.0181
278.6	0.0178
299.4	0.0168*
327.9	0.0167*
352.1	0.0164
358.4	0.0169
CURVE 20	
298.2	0.0208
CURVE 21	
298.2	0.0198
CURVE 22*	
298.2	0.0202
CURVE 23	
168.4	0.0334
175.1	0.0327
194.2	0.0291
212.3	0.0264
CURVE 23 (cont.)	
232.0	0.0250
257.1	0.0222
281.7	0.0213
301.2	0.0206*
331.1	0.0193
353.4	0.0190
CURVE 24	
298.2	0.0272
CURVE 25	
298.2	0.0346
CURVE 26	
166.7	0.0560
181.8	0.0496
200.0	0.0440
217.4	0.0399
232.6	0.0374
255.7	0.0366
283.3	0.0309
304.0	0.0295
355.8	0.0280
CURVE 27*	
298.2	0.0152
CURVE 28*	
298.2	0.0160
CURVE 29*	
298.2	0.0160
CURVE 30	
298.2	0.0320
CURVE 31	
298.2	0.0236
CURVE 32*	
298.2	0.0181
CURVE 33*	
298.2	0.0181
CURVE 34*	
298.2	0.0192
CURVE 35*	
298.2	0.0184
CURVE 36	
298.2	0.0219

* Not shown on plot

SPECIFICATION TABLE NO. 409 THERMAL CONDUCTIVITY OF ($Sb_2Te_3 + In_2Te_3$) MIXTURES

($Sb_2Te_3 + In_2Te_3$ > 95.0%; impurity < 2.0% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	833		1962	303.2		$Sb_2Te_3 - In_2Te_3$; No. [illegible]	10 mole % In_2Te_3; p-type alloy; pellet was prepared by powder metallurgical techniques; annealed for 8 hrs at 475 C; pellet size = .50 in. long and .50 in. in dia; type of heat - Vycor tube.
2	833		1962	303.2		$Sb_2Te_3 - In_2Te_3$; No. 76	18 mole % In_2Te_3; the others are the same as that of the above specimen.
3	833		1962	303.2		$Sb_2Te_3 - In_2Te_3$; No. 59	25 mole% In_2Te_3; the others are the same as that of the above specimen.
4	833		1962	303.2		$Sb_2Te_3 - In_2Te_3$; No. 10	33.3 mole% In_2Te_3; the others are the same as that of the above specimen.
5	833		1962	303.2		$Sb_2Te_3 - In_2Te_3$; No. 3384	5 mole % In_2Te_3; p-type alloy; pellet was prepared by powder metallurgical techniques; cold pressed and sintered; pellet size = .50 in. long and .50 in. in dia; type of heat - Balzers furnace.
6	833		1962	303.2		$Sb_2Te_3 - In_2Te_3$; No. 3421	6 mole % In_2Te_3; the others are the same as that of the above specimen.
7	833		1962	303.2		$Sb_2Te_3 - In_2Te_3$; No. 3423	7 mole% In_2Te_3; the others are the same as that of the above specimen.
8	833		1962	303.2		$Sb_2Te_3 - In_2Te_3$; No. 3386	10 mole % In_2Te_3; the others are the same as that of the above specimen.
9	833		1962	303.2		$Sb_2Te_3 - In_2Te_3$; No. 3390	15 mole % In_2Te_3; the others are the same as that of the above specimen.

DATA TABLE NO. 409 THERMAL CONDUCTIVITY OF (Sb_2Te_3 + In_2Te_3) MIXTURES

(Sb_2Te_3 + In_2Te_3 $\geq$ 95.0%; impurity $\leq$ 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
303.2	0.0152
CURVE 2*	
303.2	0.0094
CURVE 3*	
303.2	0.0083
CURVE 4*	
303.2	0.0083
CURVE 5*	
303.2	0.0175
CURVE 6*	
303.2	0.0159
CURVE 7*	
303.2	0.0153
CURVE 8*	
303.2	0.0112
CURVE 9*	
303.2	0.0107

* No graphical presentation

FIGURE SHOWS ONLY 9 OF THE CURVES REPORTED IN TABLE

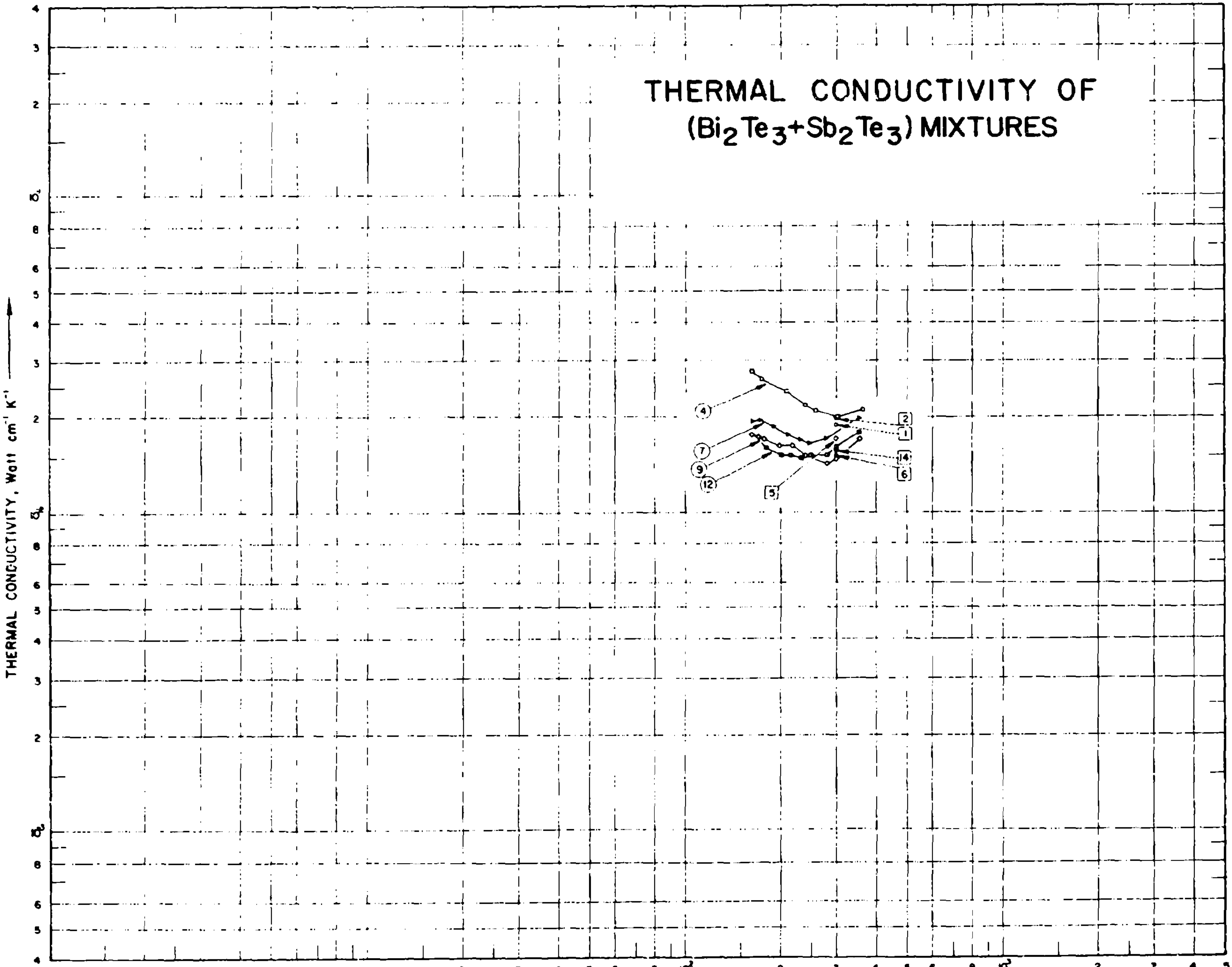


FIG 410

SPECIFICATION TABLE NO. 410 THERMAL CONDUCTIVITY OF (Bi_2Te_3 + Sb_2Te_3) MIXTURES

(Bi_2Te_3 + Sb_2Te_3 ≥ 95.0%; impurity ≤ 2.0% each)

[For Data Reported in Figure and Table No. 410]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi_2Te_3	Sb_2Te_3	Composition (continued), Specifications and Remarks
1	936	·	1965	298.2		$Bi_{1.75}Sb_{0.25}Te_{3.13}$	88.07	9.84	2.09 Te (calculated); n-type; 0.5 x 0.5 x 1 cm; prepared from 99.999 pure Bi and Sb supplied by Consolidated Mining and Smelting Co., and 99.97 pure Te supplied by Canadian Copper Refiners Ltd., materials weighed out, crushed, sealed in an ampule in a vacuum of 10^{-5} Torr, heated at 900 C for 20 hrs, rocked, cooled, zone-melted at a rate of 0.07-0.28 in. hr^{-1}, cooled and cut; thermal conductivity data calculated from measured values of figure of merit, Seebeck coefficient, and electrical conductivity; electrical conductivity reported as 1.19 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
2	936	T	1965	298.2		$Bi_{1.75}Sb_{0.25}Te_{3.13}$			Cut from the same ingot as the above specimen; electrical conductivity reported as 1.39 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
3	936	T	1965	296.2		$Bi_{1.75}Sb_{0.25}Te_{3.13}$			Similar to the above specimen except electrical conductivity reported as 1.20 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
4	936	T	1965	163-362		$Bi_{1.75}Sb_{0.25}Te_{3.13}$			Similar to the above specimen except electrical resistivity reported as 311, 340, 423, 524, 579, 721, and 912 μohm cm at 163, 175, 209, 240, 259, 302, and 361 K, respectively.
5	936	T	1965	298.2		$Bi_{1.5}Sb_{0.5}Te_{3.13}$	77.62	20.24	2.14 Te (calculated); n-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 0.7 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
6	936	T	1965	298.2		$Bi_{1.5}Sb_{0.5}Te_{3.13}$			Cut from the same ingot as the above specimen; electrical conductivity reported as 0.75 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
7	936	T	1965	162-353		$Bi_{1.5}Sb_{0.5}Te_{3.13}$			Similar to the above specimen except electrical resistivity reported as 0.622, 0.643, 0.736, 0.843, 0.937, 1.03, 1.20, 1.31, and 1.55 milliohm cm at 164, 173, 191, 212, 232, 248, 278, 299, and 352 K, respectively.
8	936	T	1965	298.2		$Bi_{1.33}Sb_{0.67}Te_{3.13}$	70.32	27.50	2.18 Te (calculated); n-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 0.70 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.

SPECIFICATION TABLE NO. 410 (continued)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi_2Te_3	Sb_2Te_3	Composition (continued), Specifications and Remarks
9	936	T	1965	164-356		$Bi_{1.33}Sb_{0.67}Te_{3.13}$			Similar to the above specimen except electrical resistivity reported as 0.689, 0.766, 0.853, 0.946, 1.10, 1.15, 1.32, 1.43, and 1.71 milliohm cm at 164, 179, 200, 220, 240, 252, 280, 301, and 354 K, respectively.
10	936	T	1965	298.2		$BiSbTe_{3.12}$	54.84	42.89	2.27 Te (calculated); n-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 0.43 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
11	936	T	1965	298.2		$BiSbTe_{3.13}$			Another run of the above specimen.
12	936	T	1965	170-355		$BiSbTe_{3.13}$			Similar to the above specimen except electrical resistivity reported as 1.27, 1.32, 1.49, 1.63, 1.80, 1.95, 2.24, 2.38, and 2.56 milliohm at 171, 181, 203, 218, 233, 250, 280, 302, and 356 K, respectively.
13	936	T	1965	298.2		$Bi_{1.75}Sb_{0.25}Te_{3.1}$	88.50	9.89	1.61 Te (calculated); n-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 0.93 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
14	936	T	1965	298.2		$Bi_{1.75}Sb_{0.25}Te_{3.19}$	87.24	9.75	3.11 Te (calculated); n-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.41 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.
15	936	T	1965	298.2		$Bi_{1.75}Sb_{0.25}Te_{3.26}$	86.28	9.64	4.08 Te (calculated); n-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 1.46 x 10^3 $ohm^{-1}cm^{-1}$ at room temperature.

DATA TABLE NO. 410 THERMAL CONDUCTIVITY OF (Bi_2Te_3 + Sb_2Te_3) MIXTURES

(Bi_2Te_3 + Sb_2Te_3 ≥95.0%; impurity 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
298.2	0.0188
CURVE 2	
298.2	0.0197
CURVE 3*	
298.2	0.0193
CURVE 4	
162.6	0.0278
174.2	0.0262
208.3	0.0241
239.8	0.0218
257.1	0.0209
302.1	0.0200
362.3	0.0210
CURVE 5	
298.2	0.0170
CURVE 6	
298.2	0.0150
CURVE 7	
162.1	0.0192
172.4	0.0195
190.5	0.0186
210.1	0.0175
231.5	0.0168
246.3	0.0165
277.8	0.0169
299.4	0.0169*
353.4	0.0198
CURVE 8*	
298.2	0.0153
CURVE 9	
163.7	0.0175
170.1	0.0172
177.9	0.0169
198.0	0.0163
218.8	0.0163
239.8	0.0151
280.1	0.0143
299.4	0.0148
355.9	0.0169
CURVE 10*	
298.2	0.0158
CURVE 11*	
298.2	0.0192
CURVE 12	
170.4	0.0172*
180.5	0.0159
201.2	0.0151
216.9	0.0151
232.6	0.0148
249.4	0.0151
280.9	0.0151
300.3	0.0161
354.6	0.0178
CURVE 13	
298.2	0.0186
CURVE 14	
298.2	0.0156
CURVE 15*	
298.2	0.0174

* Not shown on plot

SPECIFICATION TABLE NO. 411 THERMAL CONDUCTIVITY OF ($Bi_2Te_3 + Sb_2Te_3 + Sb_2Se_3$) MIXTURES

($Bi_2Te_3 + Sb_2Te_3 + Sb_2Se_3 > 95.0\%$; impurity $< 2.0\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi_2Te_3	Si_2Te_3	Sb_2Se_3	Composition (continued), Specifications and Remarks
1	947	L	1960	300			50	40	10	p-type; doped with excess Bi; electrical resistivity 0.8 milliohm cm at room temperature.

DATA TABLE NO. 411 THERMAL CONDUCTIVITY OF ($Bi_2Te_3 + Sb_2Te_3 + Sb_2Se_3$) MIXTURES

($Bi_2Te_3 + Sb_2Te_3 + Sb_2Se_3 > 95.0\%$; impurity $< 2.0\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
300	0.015

* No graphical presentation

THERMAL CONDUCTIVITY OF $(Bi_2Te_3 + Bi_2Se_3)$ MIXTURES

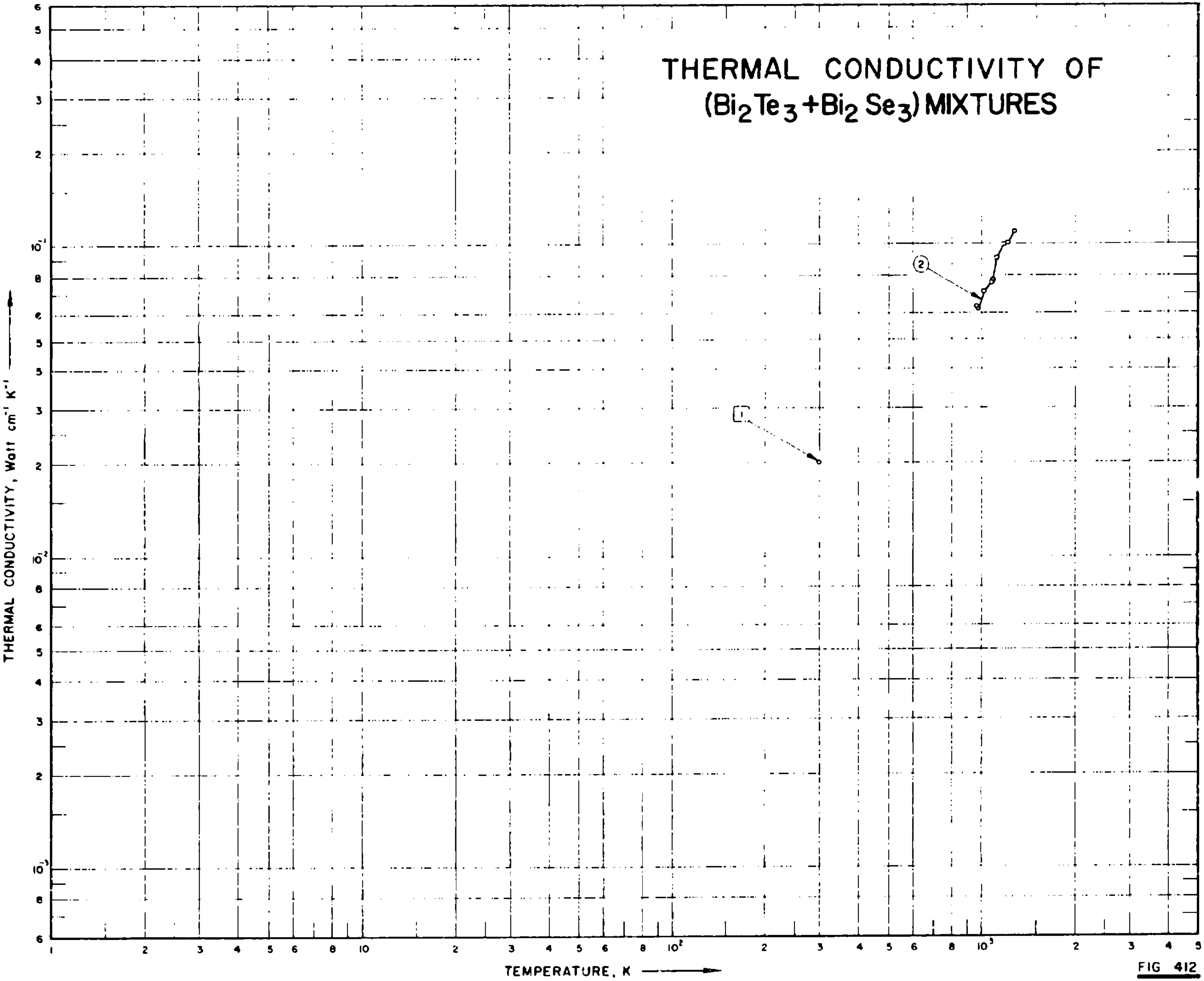


FIG 412

SPECIFICATION TABLE NO. 412 THERMAL CONDUCTIVITY OF (Bi_2Te_3 + Bi_2Se_3) MIXTURES

(Bi_2Te_3 + Bi_2Se_3 > 95.0%; impurity < 2.0% each)

[For Data Reported in Figure and Table No. 412]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi_2Te_3	Bi_2Se_3	Composition (continued), Specifications and Remarks
1	947	L	1960	300			78.6	21.4	n-type; doped with CuBr; electrical resistivity 0.6 milli-ohm cm at room temp.
2	974, 975	C	1965	971-1280	±12		-	-	80 $BiTe_3$, 20 Bi_2Se_3 (weight percent or mole percent not specified); the apparatus comprises two coaxial graphite cylinders 20 mm I.D. and 50 mm O.D., separated by a gap 3 mm wide into which the powder specimen is poured, and the annular gap itself 140 mm long; before measurement of the apparatus was sealed up and heated at 600 K for 18-20 hrs then the entire system was placed in vacuum; bismuth used as comparative material.

DATA TABLE NO. 412 THERMAL CONDUCTIVITY OF (Bi_2Te_3 + Bi_2Se_3) MIXTURES

(Bi_2Te_3 + Bi_2Se_3 $\geq$ 95.0%; impurity $\leq$ 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
300	0.020
CURVE 2	
971	0.0635
977	0.0621
1021	0.0712
1076	0.0763
1088	0.0772
1137	0.0902
1195	0.100
1227	0.102
1280	0.111

SPECIFICATION TABLE NO. 413 THERMAL CONDUCTIVITY OF (Cd_3As_2 + Zn_3As_2) MIXTURES

(Cd_3As_2 + Zn_3As_2 > 95.0%; impurity < 2.0% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cd_3As_2	Zn_3As_2	Composition (continued), Specifications and Remarks
1	972		1965	298.2		$Cd_{2.5}Zn_{0.5}As_2$; 1	87.6	12.4	Single crystal; 12 mm dia x 56 mm long; prepared by loading 99.9999 pure Cd, 99.9998 pure Zn, and 9.9995 pure As, in stoichiometric quantities, into a carbon-coated cylindrical quartz crucible, evacuated and sealed, heated till materials completely molten, rocked for a few hours, cooled at a rate of 15 C hr^{-1}; electrical resistivity 0.32 milliohm cm.
2	972		1965	298.2		$Cd_{2.5}Zn_{0.5}As_2$; 2	87.6	12.4	0.05 Cu; same dimensions and fabrication method as the above specimen; electrical resistivity 1.9 milliohm cm.
3	972		1965	298.2		Cd_2ZnAs_2; 3	73.7	26.3	Same dimensions and fabrication method as the above specimen; electrical resistivity 4.6 milliohm cm.
4	972		1965	298.2		$Cd_{1.6}Zn_{1.4}As_2$; 4	61.6	38.4	Similar to the above specimen; electrical resistivity 12 milliohm cm.

DATA TABLE NO. 413 THERMAL CONDUCTIVITY OF (Cd_3As_2 + Zn_3As_2) MIXTURES

(Cd_3As_2 + Zn_3As_2 > 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 3*	
298.2	0.023	298.2	0.012
CURVE 2*		CURVE 4*	
298.2	0.016	298.2	0.011

* No graphical presentation

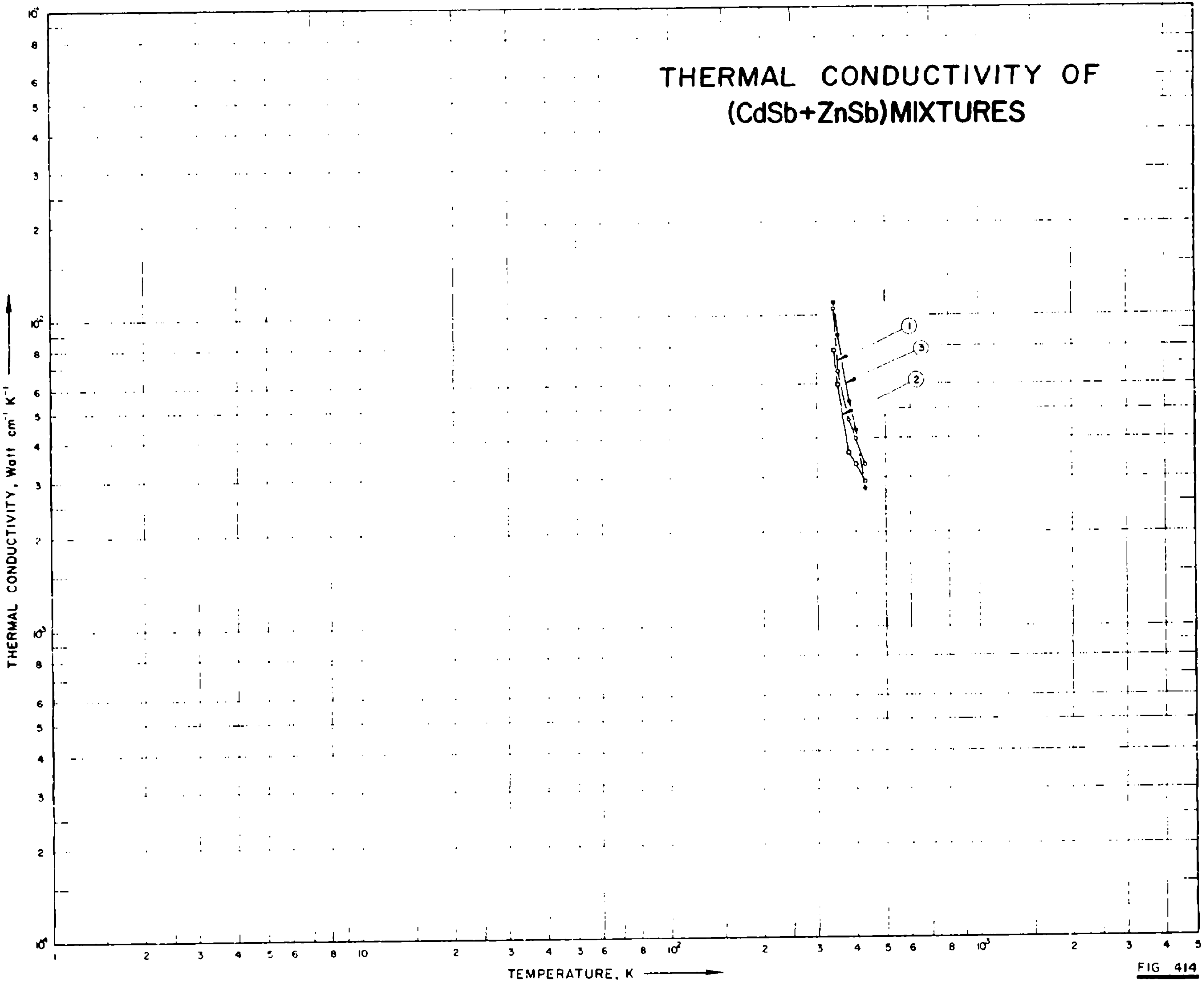

THERMAL CONDUCTIVITY OF
(CdSb+ZnSb)MIXTURES
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3

FIG 414

SPECIFICATION TABLE NO. 414 THERMAL CONDUCTIVITY OF (CdSb + ZnSb) MIXTURES

(CdSb + ZnSb ≥ 95.0%; impurity ≤ 2.0% each)

[For Data Reported in Figure and Table No. 414]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) CdSb	ZnSb	Composition (continued), Specifications and Remarks
1	979, 980	C	1960	343-433		CdSb · ZnSb	55.6	44.4	Prepared from spectroscopically pure Zn, Sb, and Cd obtained by repeated vacuum distillation, materials weighed and melted in evacuated Pyrex containers at 620-630 C, vibrated, annealed at 450-550 C for 5 hrs and at 250 C for 8 hrs; electrical resistivity reported as 0.581 and 0.231 ohm cm at 70 and 130 C, respectively; measured in high vacuum.
2	979, 980	C	1960	343-433		3CdSb · 2ZnSb	65.3	34.7	Same fabrication method as the above specimen; electrical resistivity reported as 0.188 and 0.104 ohm cm at 70 and 130 C, respectively; measured in high vacuum.
3	979, 980	C	1960	343-433		7CdSb · 3ZnSb	74.5	25.5	Same fabrication method as the above specimen; electrical resistivity reported as 0.0749 and 0.0425 ohm cm at 70 and 130 C, respectively; measured in high vacuum.

DATA TABLE NO. 414 THERMAL CONDUCTIVITY OF (CdSb + ZnSb) MIXTURES

(CdSb + ZnSb > 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
343.2	0.0106
353.2	0.00661
383.2	0.00464
403.2	0.00402
433.2	0.00335
CURVE 2	
343.2	0.00782
353.2	0.00602
383.2	0.00364
403.2	0.00335
433.2	0.00293
CURVE 3	
343.2	0.0111
353.2	0.00874
383.2	0.00531
403.2	0.00427
433.2	0.00276

SPECIFICATION TABLE NO. 415 THERMAL CONDUCTIVITY OF ($CuSbSe_2 + Cu_3Se_2$) MIXTURES

($CuSbSe_2 + Cu_3Se_2$ ≥ 95.0%; impurity ≤ 2.0% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	971		1962	298.2		$(CuSbSe_2)_{0.8}(Cu_3Se_2)_{0.2}$	p-type; specimen obtained by fusing ASARCO 99.999 pure elements in carbon-coated quartz tube with agitation, cooling, crushing, recasting in 8 mm uncoated quartz, and zone-leveling; electrical resistivity 9 ~ 11 ohm cm; melting point (with decomposition) 450 K (measuring temperature not reported, assumed room temperature).
2	971		1962	298.2		$(CuSbSe_2)_{0.9}(Cu_3Se_2)_{0.1}$	p-type; same fabrication method as the above specimen; electrical resistivity 10 ~ 16 ohm cm; melting point 440 (eutectic) to 475 K (measuring temperature assumed 25 C).
3	944		1962	298.2		$(CuSbSe_2)_{0.7}(Cu_3Se_2)_{0.3}$	n-type; same fabrication method as the above specimen; electrical resistivity 6.5 ~ 9 ohm cm; melting point 450 K (measuring temperature assumed 25 C).
4	944		1962	298.2		$(CuSbSe_2)_{0.6}(Cu_3Se_2)_{0.4}$	p-type; same fabrication method as the above specimen; electrical resistivity 2 ohm cm; melting point 450 K (measuring temperature assumed 25 C).

DATA TABLE NO. 415 THERMAL CONDUCTIVITY OF ($CuSbSe_2 + Cu_3Se_2$) MIXTURES

($CuSbSe_2 + Cu_3Se_2$ ≥ 95.0%; impurity ≤ 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1*		CURVE 4*	
298.2	0.0188	298.2	0.0184
CURVE 2*			
298.2	0.0225		
CURVE 3*			
298.2	0.0141		

* No graphical presentation

SPECIFICATION TABLE NO. 416 THERMAL CONDUCTIVITY OF (Cu_3Se_2 + $CuSbSe_2$) MIXTURES

(Cu_3Se_2 + $CuSbSe_2$ 95.0%; impurity < 2.0% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu_3Se_2	$CuSbSe_2$	Composition (continued), Specifications and Remarks
1	944		1962	298.2		$(CuSbSe_2)_{0.25}(Cu_3Se_2)_{0.75}$	75.29	24.71	p-type; specimen obtained by fusing ASARCO 99.999 pure elements in carbon-coated quartz tube with agitation, cooling, crushing, recasting in 8 mm uncoated quartz, and zone-leveling; electrical resistivity 0.4 ~ 1.65 milliohm cm; melting point 460 K (measuring temperature assumed 25 C).
2	944		1962	298.2		$(CuSbSe_2)_{0.2}(Cu_3Se_2)_{0.8}$	80.25	19.75	p-type; same fabrication method as the above specimen; electrical resistivity 0.35 milliohm cm; melting point 1049 K; phase changes at 120 and 560 K (measuring temperature assumed 25 C).
3	944		1962	298.2		$(CuSbSe_2)_{0.1}(Cu_3Se_2)_{0.9}$	90.14	9.86	p-type; same fabrication method as the above specimen; electrical resistivity 0.35 milliohm cm; melting point 870 K; phase changes at 360 and 435 K (measuring temperature assumed 25 C).
4	944		1962	298.2		$(CuSbSe_2)_{0.5}(Cu_3Se_2)_{0.5}$	50.39	49.61	p-type; same fabrication method as the above specimen; electrical resistivity 12 milliohm cm; melting point 460 K (measuring temperature assumed 25 C).
5	944		1962	298.2		$(CuSbSe_2)_{0.4}(Cu_3Se_2)_{0.6}$	60.37	39.63	p-type; same fabrication method as the above specimen; electrical resistivity 11 milliohm cm; melting point 460 K (measuring temperature assumed 25 C).
6	944		1962	298.2		$(CuSbSe_2)_{0.33}(Cu_3Se_2)_{0.67}$	67.34	32.56	p-type; same fabrication method as the above specimen; electrical resistivity 9.5 ~ 10.5 milliohm cm; melting point 460 K (measuring temperature assumed 25 C).
7	944		1962	298.2		$(CuSbSe_2)_{0.3}(Cu_3Se_2)_{0.7}$	70.32	29.68	p-type; same fabrication method as the above specimen; electrical resistivity 1.2 milliohm cm; melting point 460 K (measuring temperature assumed 25 C).

DATA TABLE NO. 416 THERMAL CONDUCTIVITY OF (Cu_3Se_2 + $CuSbSe_2$) MIXTURES

(Cu_3Se_2 + $CuSbSe_2$ > 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.0220
CURVE 2*	
298.2	0.0195
CURVE 3*	
298.2	0.0190
CURVE 4*	
298.2	0.0190
CURVE 5*	
298.2	0.0190
CURVE 6*	
298.2	0.0250
CURVE 7*	
298.2	0.0200

* No graphical presentation

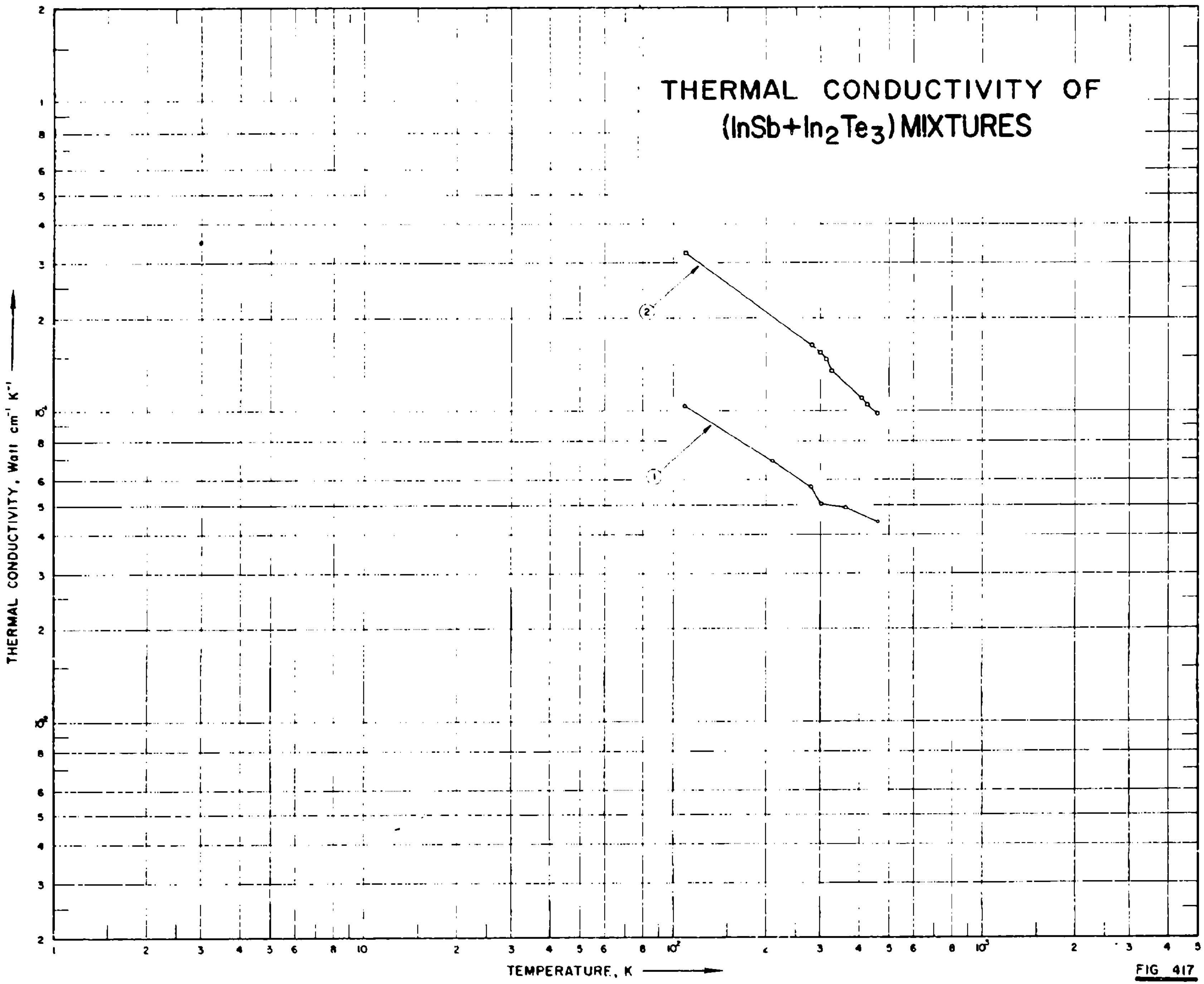

THERMAL CONDUCTIVITY OF
$(InSb+In_2Te_3)$ MIXTURES
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
1
2

FIG 417

SPECIFICATION TABLE NO. 417 THERMAL CONDUCTIVITY OF ($InSb + In_2Te_3$) MIXTUR

($InSb + In_2Te_3$ >95.0%; impurity <2.0% each)

[For Data Reported in Figure and Table No. 417]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) InSb	Composition (weight percent) In_2Te_3	Composition (continued), Specifications and Remarks
1	950, 951	L	1963	109-463			97.45	2.55	Prepared from highly pure indium, Sb-000 antimon[illegible] tellurium by multiple-zone recrystallization, synthesized in evacuated (10^{-3} mm Hg) quartz ampoule, slowly cooled.
2	950, 951	L	1963	111-461			88.01	11.99	Same fabrication method as the above specimen.

DATA TABLE NO. 417 THERMAL CONDUCTIVITY OF ($InSb + In_2Te_3$) MIXTURES

($InSb + In_2Te_3 > 95.0\%$; impurity $< 2.0\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
109	0.104
211	0.0690
280	0.0571
302	0.0505
362	0.0493
463	0.0442
CURVE 2	
111	0.323
282	0.164
300	0.154
314	0.147
328	0.135
409	0.110
427	0.105
461	0.0980

SPECIFICATION TABLE NO. 418 THERMAL CONDUCTIVITY OF ($In_2Te_3 + Cu_2Te + Ag_2Te$) MIXTURES

($In_2Te_3 + Cu_2Te + Ag_2Te$ > 95.0%; impurity < 2.0% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) In_2Te_3	Cu_2Te	Ag_2Te	Composition (continued), Specifications and Remarks
1	558	TE	1960	272.9		$Ag_{.25}Cu_{.75}InTe_2$	68.87	21.48	9.65	Quadruple covalent semiconductors.

DATA TABLE NO. 418 THERMAL CONDUCTIVITY OF ($In_2Te_3 + Cu_2Te + Ag_2Te$) MIXTURES

($In_2Te_3 + Cu_2Te + Ag_2Te$ > 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
272.9	0.0125

* No graphical presentation

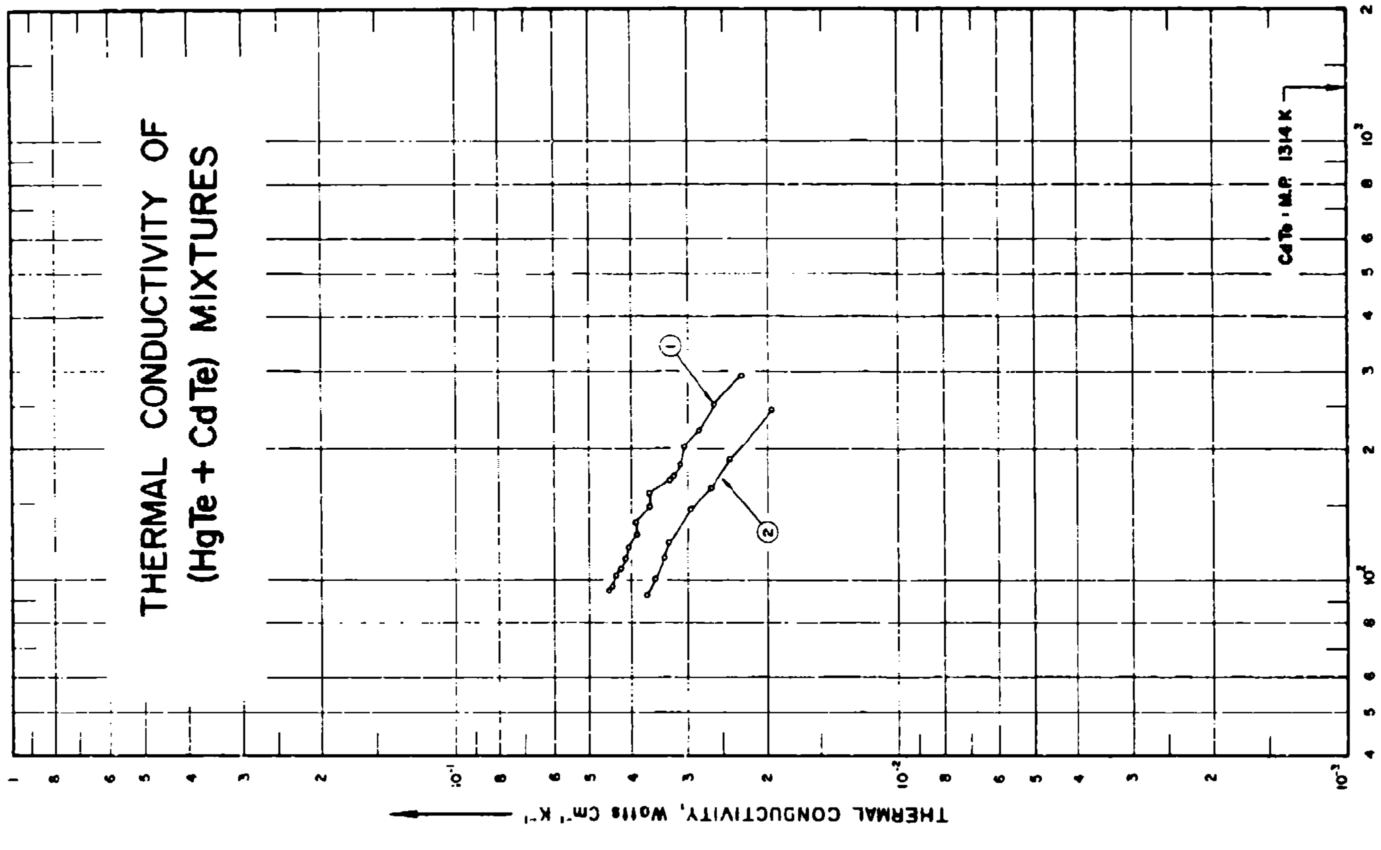

THERMAL CONDUCTIVITY OF
(HgTe + CdTe) MIXTURES
CdTe: M.P. 1314 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm^{-1} K^{-1}

FIG 419

SPECIFICATION TABLE NO. 419 THERMAL CONDUCTIVITY OF (HgTe + CdTe) MIXTURES

(HgTe + CdTe >95.0%; impurity <2.0% each)

[For Data Reported in Figure and Table No. 419]

Curve No.	Ref. No.	Method Used	Year	Temp Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) HgTe	CdTe	Composition (continued), Specifications and Remarks
1	520	L	1960	95-295	±5	$Cd_{0.04}Hg_{0.96}Te$; 9	97.04	2.96	Dilute solution of cadmium telluride in mercury telluride.
2	520	L	1960	94-246	±5	$Cd_{0.07}Hg_{0.93}Te$; 23	94.78	5.22	Dilute solution of cadmium telluride in mercury telluride.

DATA TABLE NO. 419 THERMAL CONDUCTIVITY OF (HgTe + CdTe) MIXTURES

(HgTe + CdTe ≥ 95.0%; impurity ≤ 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
95.2	0.0451
97.8	0.0443
102.6	0.0435
107.5	0.0423
113.6	0.0415
120.2	0.0403
128.2	0.0390
137.0	0.0391
148.1	0.0365
159.5	0.0368
170.1	0.0331
174.8	0.0326
185.9	0.0314
203.3	0.0306
222.2	0.0284
253.2	0.0262
295.9	0.0227
CURVE 2	
93.9	0.0374
101.9	0.0357
113.4	0.0342
122.4	0.0333
146.6	0.0296
163.4	0.0266
190.8	0.0242
245.7	0.0195

SPECIFICATION TABLE NO. 420 THERMAL CONDUCTIVITY OF ($AgSbTe_2$ + SnTe) MIXTURES

($AgSbTe_2$ + SnTe $\geq$ 95.0%; impurity $\leq$ 2.0% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) $AgSbTe_2$	SnTe	Composition (continued), Specifications and Remarks
1	553	L	1959	300		$AgSbTe_2 \cdot SnTe$	56.75	43.25	60% of SnTe by mole added to p-type $AgSbTe_2$.
2	553	L	1959	300		$AgSbTe_2 \cdot SnTe$	85.52	14.48	25 m/o SnTe.

DATA TABLE NO. 420 THERMAL CONDUCTIVITY OF ($AgSbTe_2$ + SnTe) MIXTURES

($AgSbTe_2$ + SnTe $\geq$ 95.0%; impurity $\leq$ 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
300	0.018
CURVE 2*	
300	0.01

* No graphical presentation

SPECIFICATION TABLE NO. 421 THERMAL CONDUCTIVITY OF ($SnTe + AgSbTe_2$) MIXTURES

($SnTe + AgSbTe_2 \geq 95.0\%$; impurity $\leq 2.0\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) SnTe	$AgSbTe_2$	Composition (continued), Specifications and Remarks
1	553	L	1959	300		$AgSbTe_2 \cdot SnTe$	67.02	32.98	80% of SnTe by mole added to p-type $AgSbTe_2$.

DATA TABLE NO. 421 THERMAL CONDUCTIVITY OF ($SnTe + AgSbTe_2$) MIXTURES

($SnTe + AgSbTe_2 \geq 95.0\%$; impurity $\leq 2.0\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
300	0.026

* No graphical presentation

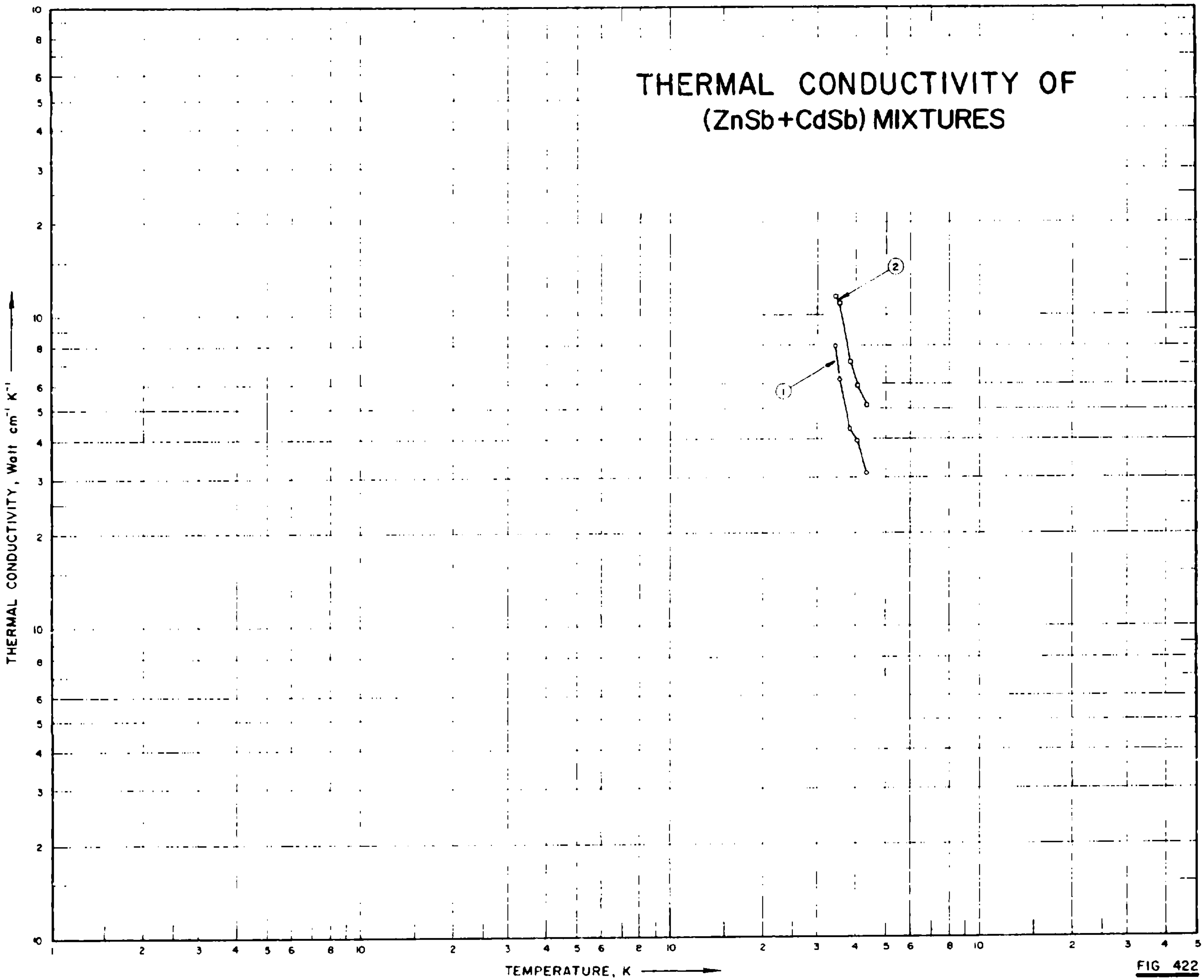

THERMAL CONDUCTIVITY OF
(ZnSb+CdSb) MIXTURES
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2

FIG 422

SPECIFICATION TABLE NO. 422 THERMAL CONDUCTIVITY OF (ZnSb + CdSb) MIXTURES

(ZnSb + CdSb ≥95.0%; impurity ≤2.0% each)

[For Data Reported in Figure and Table No. 422]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) ZnSb	CdSb	Composition (continued), Specifications and Remarks
1	979, 980	C	1960	343-433		2CdSb · 3ZnSb	54.5	45.5	Prepared from spectroscopically pure Zn, Sb, and Cd obtained by repeated vacuum distillation, materials weighed and melted in evacuated Pyrex container at 620-630 C, vibrated annealed at 450-550 C for 5 hrs and at 250 C for 8 hrs; electrical resistivity reported as 0.285 and 0.155 ohm cm at 70 and 130 C, respectively; measured in high vacuum.
2	979, 980	C	1960	343-433		3CdSb · 7ZnSb	65.1	34.9	Same fabrication method as the above specimen; electrical resistivity reported as 0.0715 and 0.0523 ohm cm at 70 and 130 C, respectively; measured in high vacuum.

DATA TABLE NO. 422 THERMAL CONDUCTIVITY OF (ZnSb + CdSb) MIXTURES

(ZnSb + CdSb $>95.0\%$; impurity $<2.0\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
343.2	0.00803
353.2	0.00628
383.2	0.00431
403.2	0.00397
433.2	0.00314
CURVE 2	
343.2	0.0116
353.2	0.0110
383.2	0.00711
403.2	0.00594
433.2	0.00519

SPECIFICATION TABLE NO. 423 THERMAL CONDUCTIVITY OF (Bi_2Te_3 + Te) MIXTURES

(Bi_2Te_3 + Te > 95.0%; impurity < 2.0% each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Bi_2Te_3	Te	Composition (continued), Specifications and Remarks
1	936	T	1965	298.2		$Bi_2Te_{3.19}$	97.06	2.94	n-type; prepared from 99.999 pure bismuth supplied by Consolidated Mining and Smelting Co. and from 99.97 pure tellurium supplied by Canadian Copper Refiners Ltd., materials weighed and out, crushed, sealed in an ampule in a vacuum of 10^{-5} Torr, heated at 900 C for 20 hrs, rocked, cooled, zone-melted at a rate of 0.07-0.28 in. hr^{-1}, then cooled and cut; thermal conductivity data calculated from measured values of the figure of merit, seebeck coefficient, and electrical conductivity; electrical conductivity reported as 1.93 x 10^3 $ohm^{-1} cm^{-1}$ at room temperature.
2	936	T	1965	298.2		$Bi_2Te_{3.28}$	96.02	3.98	n-type; same fabrication method and measuring method as the above specimen; electrical conductivity reported as 2.26 x 10^3 $ohm^{-1} cm^{-1}$ at room temperature.

DATA TABLE NO. 423 THERMAL CONDUCTIVITY OF (Bi_2Te_3 + Te) MIXTURES

(Bi_2Te_3 + Te > 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
298.2	0.0279
CURVE 2*	
298.2	0.0281

* No graphical presentation

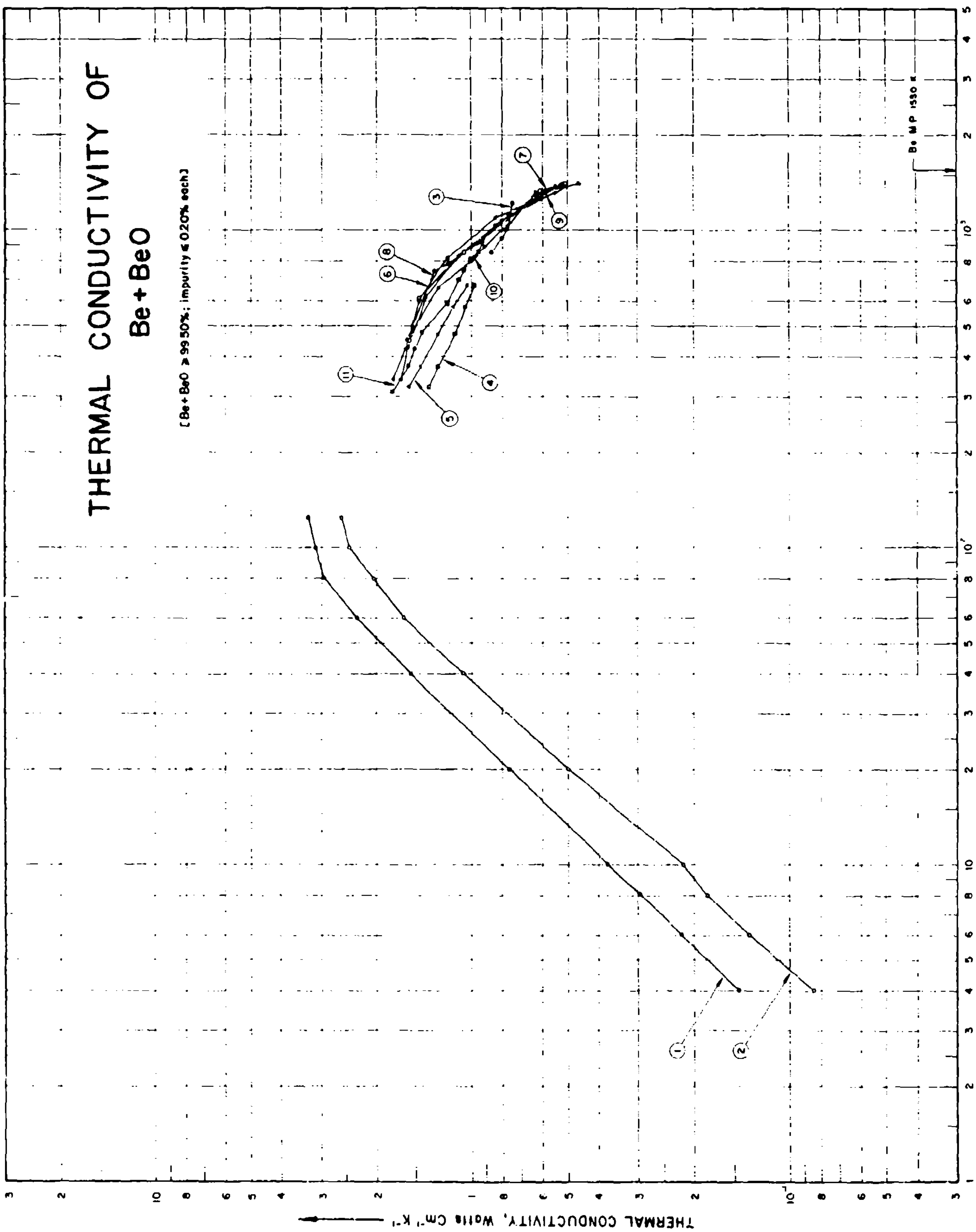

THERMAL CONDUCTIVITY OF
Be + BeO
[Be + BeO ≥ 99.50%; impurity ≤ 0.20% each]
Be M.P. 1550 K
TEMPERATURE, K
THERMAL CONDUCTIVITY, Watts Cm⁻¹ K⁻¹

FIG 424

SPECIFICATION TABLE NO. 424 THERMAL CONDUCTIVITY OF [BERYLLIUM + BERYLLIUM OXIDE] ALLOYS

(Be + BeO > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 424]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Be	BeO	Composition (continued), Specifications and Remarks
1	494		1960	4.0-125			98.700	1.2	0.956 Al, 0.035 Si, 0.016 Ni, 0.010 Mn, trace B and Li; specimen axis parallel to the pressing axis
2	494		1960	4.0-125			98.700	1.18	0.044 Al, 0.014 Ni, 0.009 Mn, trace B and Li, specimen axis perpendicular to the pressing axis.
3	43	L	1958	850-1238	5.0	YB-9052	99.160	0.84	
4	111	C	1953	323-673		IV A. R.	98.5		0.13 Al, 0.18 Fe, 0.03 Cu, 0.05 Cl, the rest BeO and other impurities; chill-cast.
5	111	C	1953	323-673		IV H. T.			The above specimen after heat treatment at 700 C.
6	513		1960	340-1400		Y 6825	98.322	1.48	0.003 Mg, 0.015 Al, 0.01 Si, 0.001 Ca, 0.002 Ti, 0.008 Cr, 0.005 Mn, 0.015 Fe, and 0.004 Cu.
7	513		1960	450-1400		Y 9384	98.892	0.845	0.006 Mg, 0.05 Al, 0.008 Si, 0.002 Ca, 0.004 Ti, 0.01 Cr, 0.008 Mn, 0.15 Fe, 0.015 Ni, 0.01 Cu.
8	513		1960	450-1375		Y 6826	98.553	1.292	0.01 Mg, 0.03 Al, 0.02 Si, 0.002 Ca, 0.002 Ti, 0.01 Cr, 0.006 Mn, 0.15 Fe, 0.015 Ni, 0.01 Cu.
9	513		1960	340-1390		YB 1000	98.509	1.229	0.015 Mg, 0.03 Al, 0.008 Si, 0.002 Ca, 0.002 Ti, 0.01 Cr, 0.01 Mn, 0.15 Fe, 0.02 Ni, 0.015 Cu.
10	513		1960	480-1400		LYB 1102	98.641	0.992	0.02 Mg, 0.04 Al, 0.04 Si, 0.002 Ca, 0.004 Ti, 0.02 Cr, 0.008 Mn, 0.20 Fe, 0.02 Ni, and 0.01 Cu.
11	513		1960	310-1035		BMI 5	99.084	0.609	0.015 Mg, 0.03 Al, 0.01 Si, 0.001 Ca, 0.003 Ti, 0.015 Cr, 0.008 Mn, 0.20 Fe, 0.015 Ni, and 0.015 Cu.

DATA TABLE NO. 424 THERMAL CONDUCTIVITY OF [BERYLLIUM + BERYLLIUM OXIDE] ALLOYS

(Be + BeO ≥99.50%; impurity ≤0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1	
4.0	0.145
6.0	0.22
8.0	0.295
10.0	0.375
20.0	0.765
40.0	1.56
60.0	2.30
80.0	2.95
100.0	3.15
125.0	3.30
CURVE 2	
4.0	0.0845
6.0	0.135
8.0	0.183
10.0	0.217
20.0	0.50
40.0	1.07
60.0	1.65
80.0	2.05
100.0	2.45
125.0	2.60
CURVE 3	
850.2	0.869
947.6	0.800
1032.8	0.774
1139.6	0.760
1237.5	0.744
CURVE 4	
323.2	1.350
373.2	1.260
473.2	1.120
573.2	1.040
673.2	0.970
CURVE 5	
323.2	1.580
CURVE 5 (cont.)	
373.2	1.440
473.2	1.260
573.2	1.130
673.2	1.030
CURVE 6	
340	1.757
425	1.632
600	1.464
820	1.172
1100	0.837
1255	0.628
1315	0.586
1400	0.523
CURVE 7	
450	1.569
610	1.464
850	1.046
1120	0.753
1260	0.628
1340	0.607
1400	0.502
CURVE 8	
450	1.590
745	1.297
780	1.172
910	0.962
1160	0.711
1290	0.628
1375	0.544
CURVE 9	
340	1.674
430	1.590
620	1.381
830	1.088
1080	0.795
CURVE 9 (cont.)	
1255	0.607
1310	0.544
1390	0.502
CURVE 10	
480	1.548
660	1.255
800	1.004
890	0.900
1060	0.753
1325	0.628
1400	0.460
CURVE 11	
310	1.778
375	1.590
425	1.506
480	1.423
590	1.172
700	1.088
750	1.046
810	1.004
860	0.941
920	0.920
1035	0.837

SPECIFICATION TABLE NO. 425 THERMAL CONDUCTIVITY OF [CHROMIUM + ALUMINUM OXIDE] ALLOYS

($Cr + Al_2O_3 \geq 95.0\%$; impurity $\leq 2.0\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cr	Al_2O_3	Composition (continued), Specifications and Remarks
1	981		1957	293.2			80	20	

DATA TABLE NO. 425 THERMAL CONDUCTIVITY OF [CHROMIUM + ALUMINUM OXIDE] ALLOYS

($Cr + Al_2O_3 \geq 95.0\%$; impurity $\leq 2.0\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1} K^{-1}$]

T	k
CURVE 1*	
293.2	0.460

* No graphical presentation

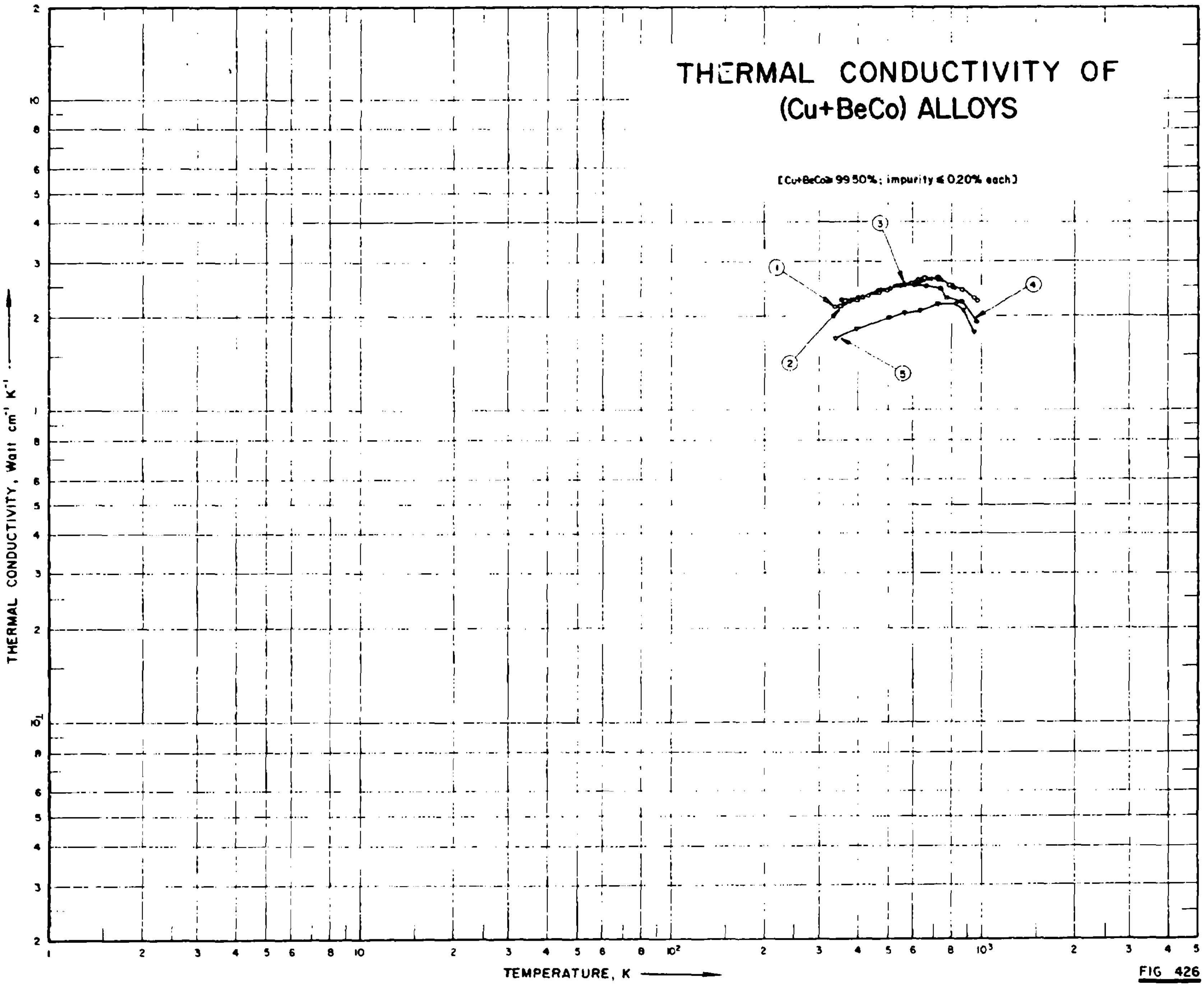

THERMAL CONDUCTIVITY OF
(Cu+BeCo) ALLOYS
[Cu+BeCo ≥ 99.50%; impurity ≤ 0.20% each]
1
2
3
4
5
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K

FIG 426

SPECIFICATION TABLE NO. 426 THERMAL CONDUCTIVITY OF [Cu + BeCo] ALLOYS

(Cu + BeCo > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 426]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Cu	BeCo	Composition (continued), Specifications and Remarks
1	541		1959	338-968			98.49	1.51	(1.31 Co, 0.2 Be); specimen quenched then tempered at 740 C in radial section.
2	541		1959	350-791			97.08	2.92	(2.52 Co, 0.4 Be); specimen quenched then tempered at 740 C in radial section.
3	541		1959	376-810			96.23	3.77	(3.27 Co, 0.5 Be); specimen quenched then tempered at 700 C in radial section.
4	541		1959	355-960			94.72	5.28	(4.58 Co, 0.7 Be); specimen quenched then tempered at 700 C in radial section.
5	541		1959	340-947			93.21	6.79	(5.89 Co, 0.9 Be); specimen quenched then tempered at 700 C in radial section.

DATA TABLE NO. 426 THERMAL CONDUCTIVITY OF (Cu + BeCo) ALLOYS

(Cu + BeCo > 99.50%; impurity <0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k	T	k
CURVE 1		CURVE 4 (cont.)	
338.2	2.16	868.2	2.24
432.2	2.34	960.2	1.93
498.2	2.44		
567.2	2.52	CURVE 5	
629.2	2.65		
721.2	2.65	340.2	1.70
805.2	2.52	398.2	1.83
861.2	2.46	501.2	1.98
948.2	2.30	563.2	2.06
968.2	2.26	638.2	2.09
		728.2	2.20
CURVE 2		834.2	2.20
		870.2	2.11
350.2	2.17	947.2	1.78
399.2	2.27		
467.2	2.41		
597.2	2.57		
658.2	2.68		
728.2	2.67		
791.2	2.54		
CURVE 3			
376.2	2.24		
413.2	2.30		
469.2	2.41		
508.2	2.46		
563.2	2.55		
628.2	2.57		
713.2	2.68		
810.2	2.52		
CURVE 4			
355.2	2.26		
403.2	2.30		
473.2	2.43		
550.2	2.51		
608.2	2.55		
675.2	2.52		
738.2	2.47		
771.2	2.30		

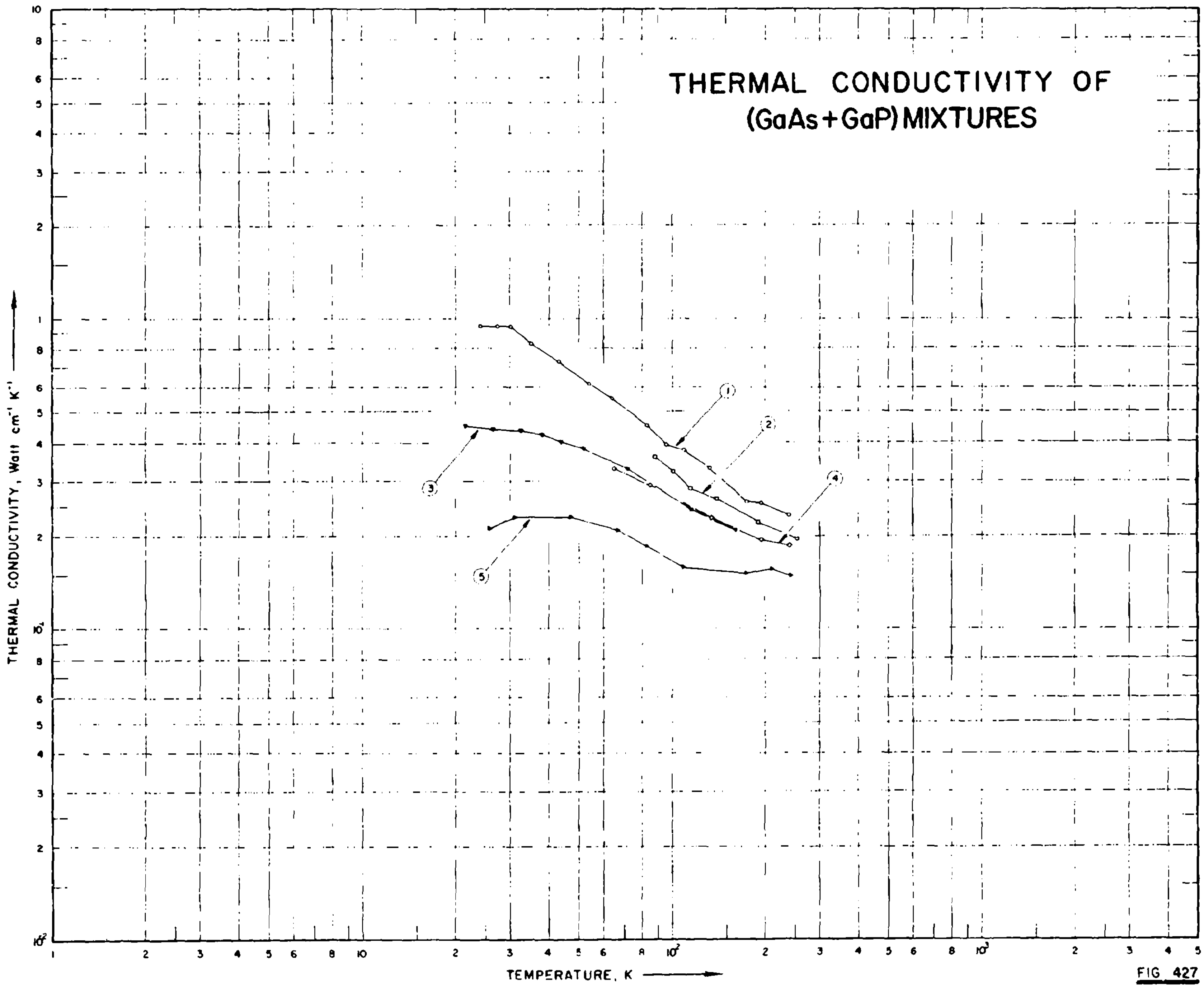

THERMAL CONDUCTIVITY OF
(GaAs+GaP) MIXTURES
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1
2
3
4
5

FIG 427

SPECIFICATION TABLE NO. 427 THERMAL CONDUCTIVITY OF (GaAs + GaP) MIXTURES

(GaAs + GaP > 95.0%; impurity < 2.0% each)

[For Data Reported in Figure and Table No. 427]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) GaAs	Composition (weight percent) GaP	Composition (continued), Specifications and Remarks
1	946	L	1965	24-239	±10	$GaAs_{0.9}P_{0.1}$; FH112	92.8	7.2	n-type Te-doped polycrystalline; 1.0 x 1.5 x 8 mm; prepared by a closed tube vapor transport method using $PbCl_2$ as the transport agent, the sealed quartz tube moved slowly through a stationary temperature gradient; carrier concentration 4 x 10^{18} cm^{-3}.
2	946	L	1965	88-254	±10	$GaAs_{0.8}P_{0.2}$; 6302	85.2	14.8	n-type Si-doped polycrystalline; same dimensions and fabrication method as the above specimen; carrier concentration 2 x 10^{18} cm^{-3}.
3	946	L	1965	22-161	±10	$GaAs_{0.67}P_{0.33}$; GM50	74.0	26.0	n-type Se-doped polycrystalline; same dimensions and fabrication method as the above specimen; carrier concentration 2 x 10^{18} cm^{-3}.
4	946	L	1965	66-241	±10	$GaAs_{0.65}P_{0.35}$	72.7	27.3	n-type Te-doped polycrystalline; same dimensions; fabrication method, and carrier concentration as the above specimen.
5	946	L	1965	26-243	±10	$GaAs_{0.5}P_{0.5}$; 6407	59.0	41.0	Similar to the above specimen, except carrier concentration 3 x 10^{18} cm^{-3}.

DATA TABLE NO. 427 THERMAL CONDUCTIVITY OF (GaAs + GaP) MIXTURES

(GaAs + GaP ≥ 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k
CURVE 1		CURVE 5	
24.2	0.944	25.7	0.212
27.4	0.944	31.1	0.230
30.2	0.944	47.0	0.230
35.3	0.928	66.9	0.209
43.2	0.730	82.8	0.185
54.0	0.619	108.1	0.157
64.3	0.551	174.6	0.151
83.4	0.451	211.8	0.156
96.2	0.396	242.8	0.148
109.1	0.381		
133.4	0.332		
175.0	0.257		
196.8	0.255		
239.4	0.232		
CURVE 2			
88.1	0.351		
101.2	0.322		
114.0	0.284		
139.3	0.263		
191.9	0.221		
254.2	0.196		
CURVE 3			
21.5	0.451		
26.4	0.441		
32.5	0.435		
38.2	0.421		
43.9	0.403		
51.7	0.382		
71.8	0.328		
115.6	0.243		
161.1	0.207		
CURVE 4			
65.5	0.330		
84.6	0.290		
134.0	0.227		
194.1	0.194		
240.5	0.186		

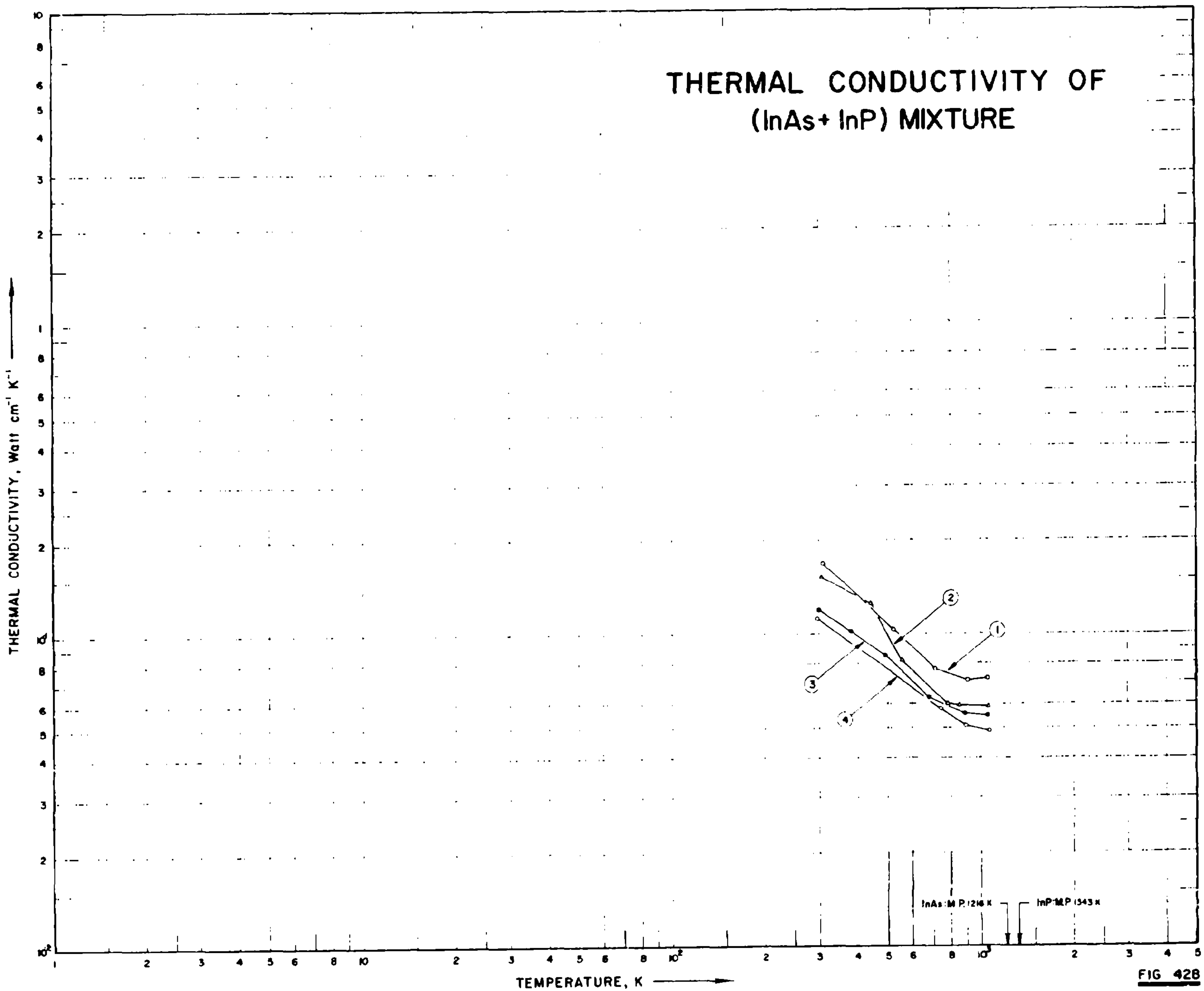

THERMAL CONDUCTIVITY OF
(InAs+ InP) MIXTURE
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
InAs: M.P. 1216 K
InP: M.P. 1343 K

FIG 428

SPECIFICATION TABLE NO. 428 THERMAL CONDUCTIVITY OF (InAs + InP) MIXTURES

(InAs + InP > 95.0% ; impurity < 2.0% each)

[For Data Reported in Figure and Table No. 428]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) InAs	Composition (weight percent) InP	Composition (continued), Specifications and Remarks
1	567	C	1959	310-1063	10	$InAs_{0.95}P_{0.05}$	96.11	3.89	n-type; free from group VI doping agent; extrinsic carrier concentration 4×10^{17} cm^{-3}; specimen made from 99.999 pure indium, 99.999 pure arsenic, and commercial white phosphorus purified by repeated steam distillation; specimen prepared in a two-zone tube furnace with carefully controlled phosphorus vapor pressure; FH stainless steel (checked by Armco iron) used as the comparative material.
2	567	C	1959	305-1066	10	$InAs_{0.9}P_{0.1}$	92.13	7.87	Similar to the above specimen but preapred by diluting specimens of higher phosphorus content with the proper amount of indium and arsenic, sealing off under vacuum, reacting and lowering at a rate of about 2.5 cm hr^{-1} through a temperature of gradient at the melting point; extrinsic carrier concentration 6×10^{16} cm^{-3}.
3	567	C	1959	303-1058	10	$InAs_{0.8}P_{0.2}$	83.89	16.11	Similar to the specimen $InAs_{0.95}P_{0.05}$ but with a carrier concentration of $10^{17} cm^{-3}$.
4	567	C	1959	298-1075	10	$InAs_{0.6}P_{0.4}$	66.13	33.87	Similar to the above specimen but with a carrier concentration of 2×10^{17} cm^{-3}.

DATA TABLE NO. 428 THERMAL CONDUCTIVITY OF (InAs + InP) MIXTURES

(InAs + InP > 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
310	0.169
524	0.103
713	0.077
913	0.071
1063	0.072
CURVE 2	
305	0.152
445	0.125
551	0.082
783	0.060
853	0.0595
1066	0.0590
CURVE 3	
303	0.119
383	0.102
493	0.085
685	0.063
895	0.056
1058	0.055
CURVE 4	
298	0.112
743	0.056
900	0.051
1075	0.049

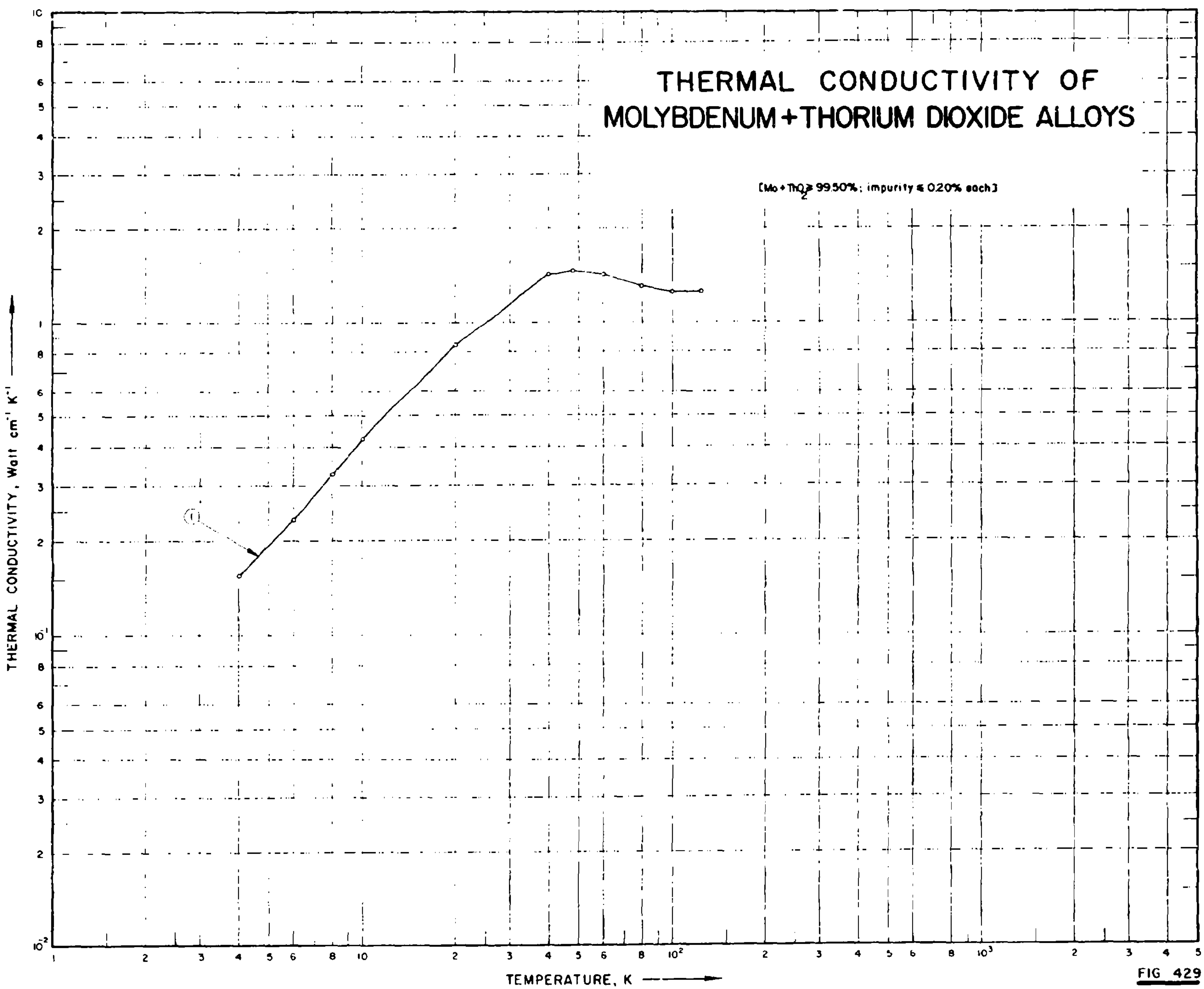

THERMAL CONDUCTIVITY OF
MOLYBDENUM + THORIUM DIOXIDE ALLOYS
[Mo + ThO2 ≥ 99.50%; impurity ≤ 0.20% each]
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1

FIG 429

SPECIFICATION TABLE NO. 429 THERMAL CONDUCTIVITY OF [MOLYBDENUM + THORIUM DIOXIDE] ALLOYS

(Mo + ThO_2 > 99.50%; impurity < 0.20% each)

[For Data Reported in Figure and Table No. 429]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	494		1950	4-125			0.001-0.01 Al, 0.001-0.01 Cu, 0.01-0.1 Fe, 0.001-0.01 Nb, 0.01-0.1 Si, trace Ca, Cr and Mg; doped by ThO_2 1-2 by volume; ground down to a rod with 3.67 mm dia and 13 cm long.

DATA TABLE NO. 429 THERMAL CONDUCTIVITY OF [MOLYBDENUM + THORIUM DIOXIDE] ALLOYS

(Mo + ThO_2 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, W cm^{-1} K^{-1}]

T	k
CURVE 1	
4.0	0.155
6.0	0.235
8.0	0.325
10.0	0.425
20.0	0.845
40.0	1.43
48.0	1.46
60.0	1.43
80.0	1.30
100.0	1.25
125.0	1.25

SPECIFICATION TABLE NO. 430 THERMAL CONDUCTIVITY OF [SODIUM + DISODIUM OXIDE] ALLOYS

($Na + Na_2O \geq 99.50\%$; impurity $\leq 0.20\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	868, 867	L	1965	328	< 15		4.9 Na_2O.
2	868, 867	L	1965	328	< 15		5.3 Na_2O.
3	868, 867	L	1965	328	< 15		7.1 Na_2O.
4	868, 867	L	1965	328	< 15		7.6 Na_2O.
5	868, 867	L	1965	328	< 15		7.6 Na_2O.
6	868, 867	L	1965	328	< 15		23.0 Na_2O.
7	868, 867	L	1965	328	< 15		25.1 Na_2O.
8	868, 867	L	1965	328	< 15		28.2 Na_2O.
9	868, 867	L	1965	328	< 15		44.4 Na_2O.
10	868, 867	L	1965	328	< 15		47.7 Na_2O.

DATA TABLE NO. 430 THERMAL CONDUCTIVITY OF [SODIUM + DISODIUM OXIDE] ALLOYS

($Na + Na_2O \geq 99.50\%$; impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k	T	k	T	k	T	k
CURVE 1*		CURVE 4*		CURVE 7*		CURVE 10*	
328	1.08	328	1.14	328	0.719	328	0.540
CURVE 2*		CURVE 5*		CURVE 8*			
328	1.00	328	1.02	328	0.708		
CURVE 3*		CURVE 6*		CURVE 9*			
328	1.14	328	0.778	328	0.484		

* No graphical presentation

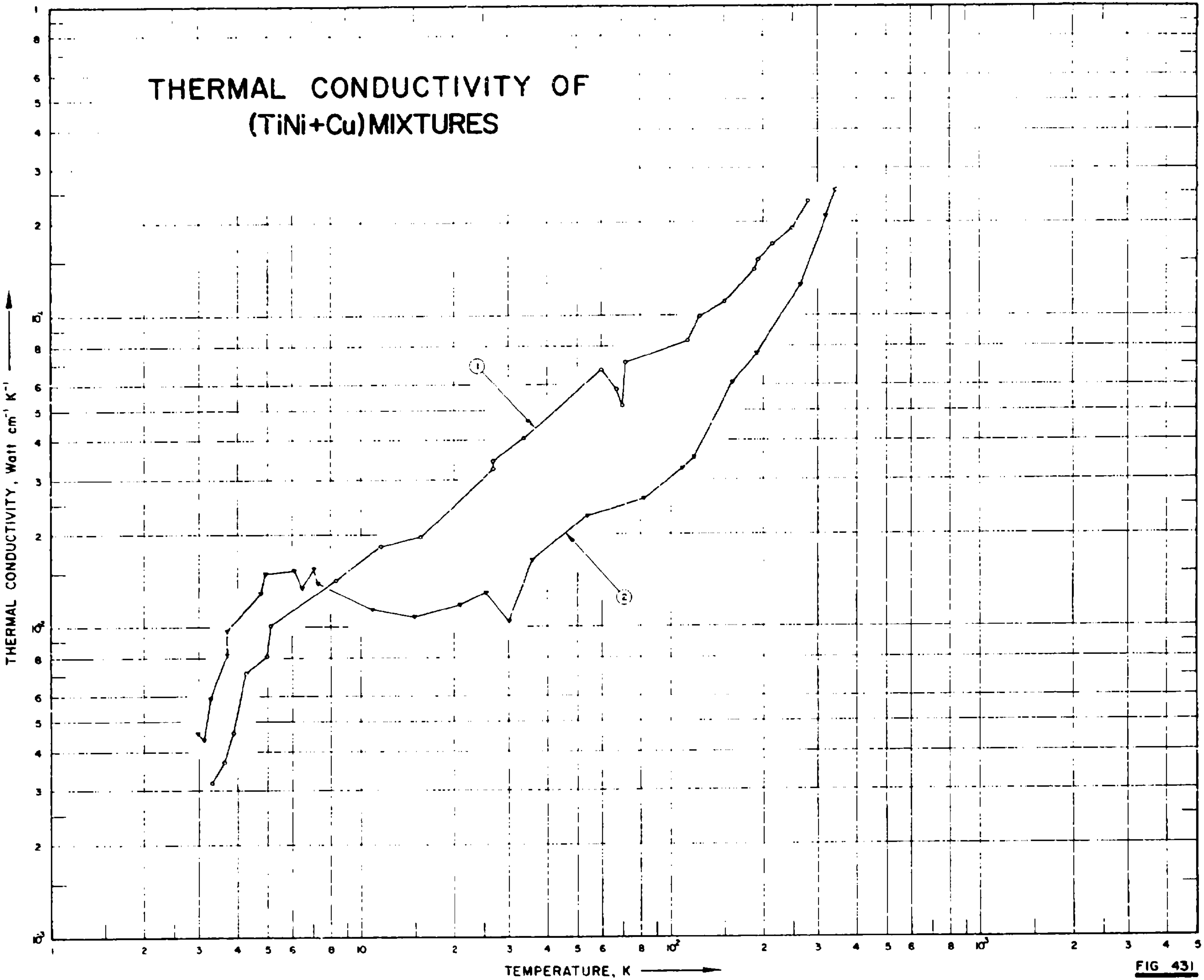

THERMAL CONDUCTIVITY OF
(TiNi+Cu) MIXTURES
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K
1
2

FIG 431

SPECIFICATION TABLE NO. 431 THERMAL CONDUCTIVITY OF (TiNi + Cu) MIXTURES

(TiNi + Cu > 95.0%; impurity < 2.0% each)

[For Data Reported in Figure and Table No. 431]

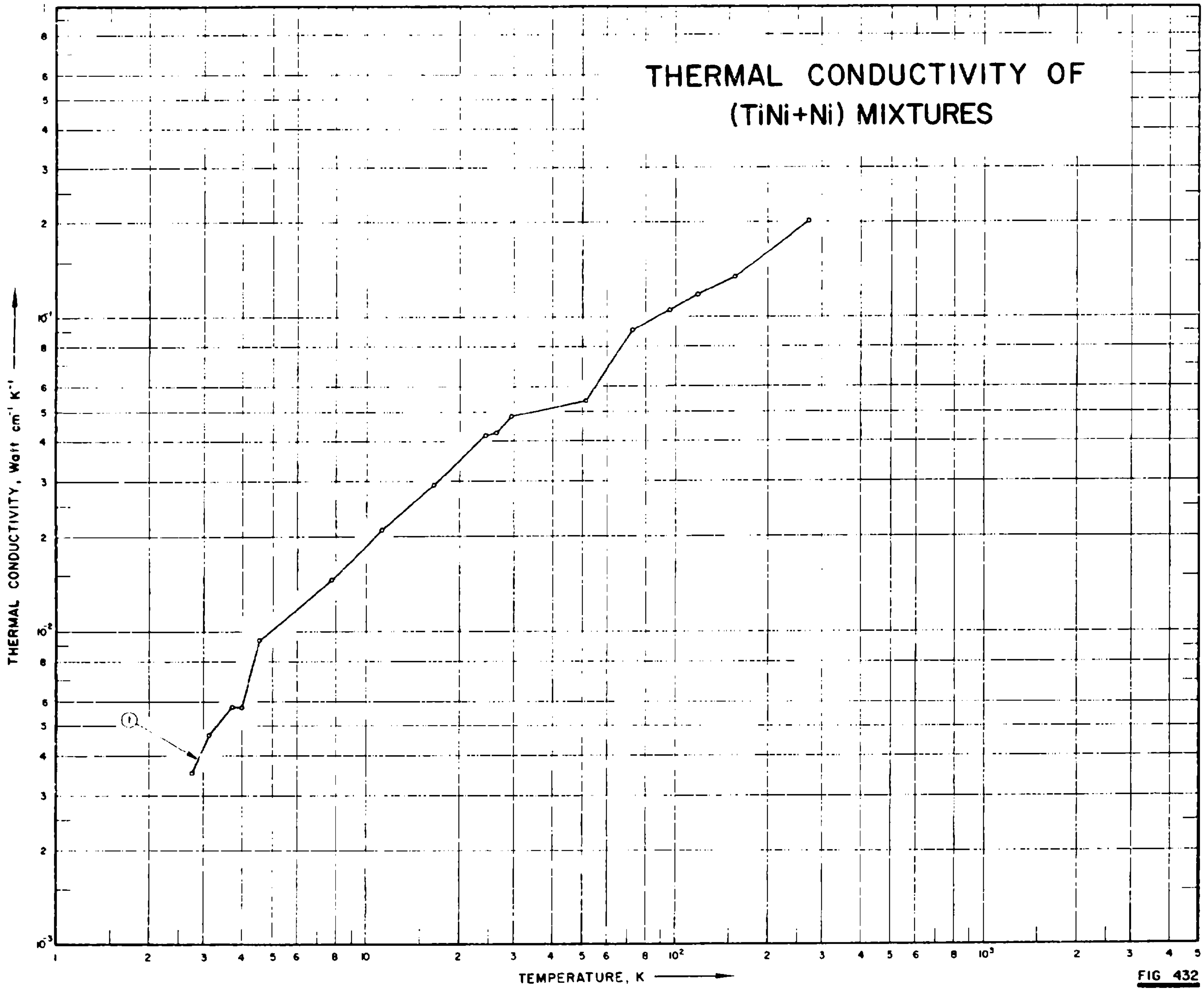
Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent)		Composition (continued), Specifications and Remarks
							TiNi	Cu	
1	965	L	1964	3.3-279	5	TiNi + 2Cu	98.0	2.0	Prepared from Mond nickel shot (99.9+ pure) and DuPont high purity sponge, the titanium contained up to: 0.08 Mg, 0.07 Fe, 0.05 Mn, 0.04 Si, and 0.15 other impurities; rods were hot swaged and furnace cooled from homogenized buttons and machined into cylinder of 0.4 cm dia x 3 cm long; grain size ~46 μ; electrical resistivity reported as 41.0, 41.0, 41.0, 40.7, 41.3, 41.0, 41.2, 41.4, 43.2, 49.2, 52.1, 55.0, 60.3, 67.3, 68.2, 79.6, 78.7, and 80.2 μohm cm at 2.90, 3.29, 3.67, 4.05, 8.61, 12.7, 21.8, 32.0, 48.5, 76.2, 95.1, 118.9, 158.9, 204.6, 212.3, 291.1, 301.3, and 304.8 K, respectively.
2	965	L	1964	2.9-342	5	TiNi + 8Cu	92.0	8.0	Same fabrication method and dimensions as the above specimen; grain size ~54 μ; electrical resistivity reported as 0.111; 0.111, 0.112, 0.112, 0.111, 0.112, 0.111; 0.111, 0.111, 0.111, 0.107, 0.103, 0.0942, and 0.0877 milli-ohm cm at 2.22, 3.66, 4.11, 4.97, 7.60, 15.7, 30.9, 53.0, 77.5, 91.6, 115.3, 146.9, 204.6, and 300.6 K, respectively.

DATA TABLE NO. 431 THERMAL CONDUCTIVITY OF (TiNi + Cu) MIXTURES

(TiNi + Cu > 95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
3.31	0.00316
3.63	0.00370
3.88	0.00460
4.28	0.00715
4.96	0.00813
5.11	0.0101
8.30	0.0143
11.6	0.0182
15.6	0.0196
26.8	0.0324
26.8	0.0342
33.6	0.0406
39.6	0.0673
67.3	0.0581
69.5	0.0516
71.5	0.0710
114.3	0.0832
125.3	0.9991
150.0	0.111
187.1	0.140
193.2	0.151
215.8	0.170
247.7	0.191
279.3	0.232
CURVE 2	
2.92	0.00457
3.12	0.00438
3.28	0.00589
3.70	0.00819
3.70	0.00973
4.76	0.0129
4.94	0.0150
6.14	0.0152
6.46	0.0135
7.05	0.0155
7.26	0.0139
10.9	0.0114
14.9	0.0108
20.9	0.0118
CURVE 2 (cont.)	
25.5	0.0130
30.1	0.0104
35.7	0.0164
53.8	0.0229
82.4	0.0260
109.6	0.0325
119.4	0.0350
153.9	0.0608
191.4	0.0785
264.9	0.126
319.2	0.208
342.0	0.252



THERMAL CONDUCTIVITY OF
(TiNi+Ni) MIXTURES
THERMAL CONDUCTIVITY, Watt cm⁻¹ K⁻¹
TEMPERATURE, K
1

FIG 432

SPECIFICATION TABLE NO. 432 THERMAL CONDUCTIVITY OF (TiNi + Ni) MIXTURES

(TiNi + Ni > 95.0%; impurity < 2.0% each)

[For Data Reported in Figure and Table No. 432]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) TiNi	Ni	Composition (continued), Specifications and Remarks
1	965	L	1964	2.8-271	5	TiNi + 18Ni	82	18	Prepared by mixing Mond nickel shots (99.9* pure) and DuPont high purity sponge; the titanium contained up to: 0.08 Mg, 0.07 Fe, 0.05 Mn, 0.04 Si, and 0.15 other impurities; specimen rod were hot swaged and furnace cooled from homogenized buttons and machined into a cylinder of 0.4 cm dia x 3 cm long; electrical resistivity reported as 27.5, 27.2, 27.6, 27.5, 28.0, 27.8, 28.8, 29.9, 31.0, 34.7, 35.8, 39.0, 42.4, 44.2, 52.2, 59.7, 63.0, and 69.3 μohm cm at 2.37, 4.13, 5.50, 7.26, 11.8, 19.3, 27.7, 45.1, 59.3, 74.0, 79.4, 95.1, 111.7, 130.6, 167.9, 209.9, 248.3, and 302.0 K, respectively.

DATA TABLE NO. 432 THERMAL CONDUCTIVITY OF (TiNi + Ni) MIXTURES

(TiNi + Ni ~95.0%; impurity < 2.0% each)

[Temperature, T, K; Thermal Conductivity, k, Watt cm^{-1}K^{-1}]

T	k
CURVE 1	
2.76	0.00353
3.13	0.00466
3.71	0.00579
3.99	0.00574
4.53	0.00933
7.73	0.0145
11.3	0.0210
16.6	0.0292
24.4	0.0420
26.4	0.0428
29.5	0.0482
51.5	0.0542
72.9	0.0916
96.6	0.107
119.4	0.119
157.0	0.136
271.0	0.204

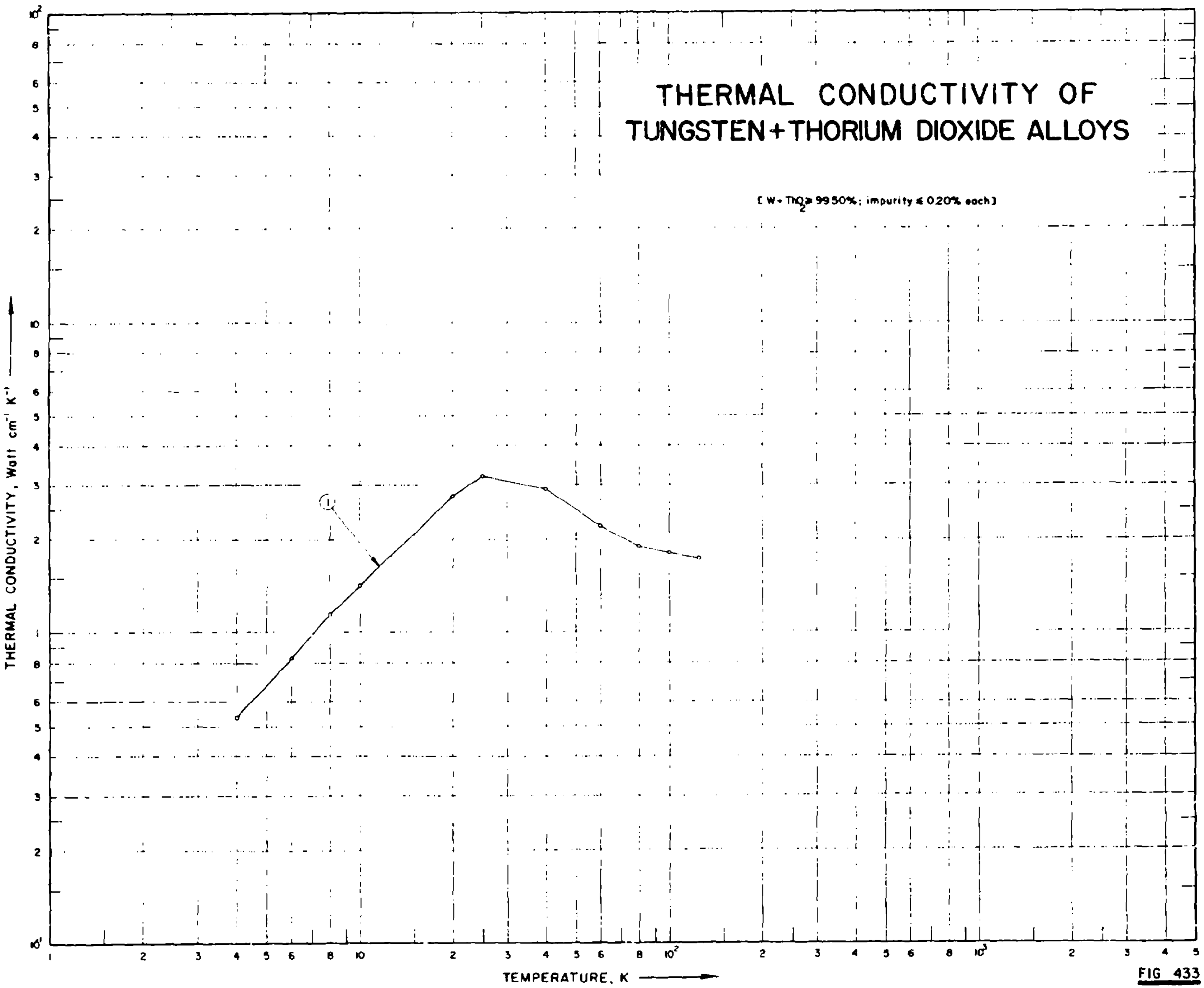

THERMAL CONDUCTIVITY OF
TUNGSTEN + THORIUM DIOXIDE ALLOYS
[W + ThO_2 ≥ 99.50%; impurity ≤ 0.20% each]
1
THERMAL CONDUCTIVITY, Watt cm^{-1} K^{-1}
TEMPERATURE, K

FIG 433

SPECIFICATION TABLE NO. 433 THERMAL CONDUCTIVITY OF [TUNGSTEN + THORIUM DIOXIDE] ALLOYS

($W + ThO_2$ ≥ 99.50%; impurity ≤ 0.20% each)

[For Data Reported in Figure and Table No. 433]

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent), Specifications and Remarks
1	494		1960	4-125			0.001-0.1 Fe, 0.091-0.01 Nb, 0.01-0.1 Si, trace Al, Cr, Cu, Mg, Mn, Mo; doped by ThO_2 1-2 by volume; ground to a rod with 3.67 mm dia and 13 cm long.

DATA TABLE NO. 433 THERMAL CONDUCTIVITY OF [TUNGSTEN + THORIUM DIOXIDE] ALLOYS

($W + ThO_2 > 99.50\%$; impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1	
4.0	0.535
6.0	0.83
8.0	1.15
10.0	1.43
20.0	2.75
25.0	3.20
40.0	2.90
60.0	2.20
80.0	1.90
100.0	1.80
125.0	1.73

SPECIFICATION TABLE NO. 434 THERMAL CONDUCTIVITY OF [URANIUM + URANIUM DIOXIDE] ALLOYS

($U + UO_2 \geq 99.50\%$; impurity $< 0.20\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) U	Composition (weight percent) UO_2	Composition (continued), Specifications and Remarks
1	843	-	1966	298.2			98.3	1.7	Spherical uranium powder obtained from National Lead Co. containing impurities: 0.05 Fe, 0.01 Mg, 0.008 Mo, 0.005 Si, < 0.005 K, < 0.005 P, < 0.005 Ti, < 0.005 Zn, < 0.002 Ca, < 0.001 As, < 0.001 Na, 0.0005 Ni, < 0.0005 Al, < 0.0005 Co, < 0.0005 Sn, 0.0004 Mn, 0.0002 Cu, 0.0001 Pb, traces of Ag, Bi, Cr, Li, Sb, Be, and B; oxidized to desired percentage by spreading over the bottom of a Petri dish and placed in an oven at 150 C; specimen contained in a 0.75 in. dia x 2 in. long cylindrical cell; mesh size -70 +80; thermal conductivity measured by using the transient line source method, the heat source was a 36-gauge constantan wire contained in a 0.025 in. O.D. hypodermic tube soldered along the axis of the cylindrical cell, data calculated from the measured line temperature at two certain times; measured in nitrogen at 1 atm.
2	843	-	1966	298.2			98.3	1.7	Similar to the above specimen; measured in nitrogen under pressure in the range $1.68 \times 10^{-2} \sim 5.433 \times 10^{3}$ mm Hg.
3	843	-	1966	298.2			94.9	5.1	Similar to the above specimen; measured in nitrogen at 1 atm.
4	843	-	1966	298.2			94.9	5.1	Similar to the above specimen; measured in nitrogen under pressure in the range $7.00 \times 10^{-3} \sim 4.842 \times 10^{3}$ mm Hg.
5	843	-	1966	298.2			86.6	13.4	Similar to the above specimen; measured in nitrogen at 1 atm.
6	843	-	1966	298.2			86.6	13.4	Similar to the above specimen; measured in nitrogen under pressure in the range $4.03 \times 10^{-3} \sim 5370$ mm Hg.
7	843	-	1966	298.2			91.6	8.4	Same impurities, source, and measuring method as the above specimen; mesh size -230 +325; measured in nitrogen at 1 atm.
8	843	-	1966	298.2			91.6	8.4	Similar to the above specimen; measured in nitrogen under pressure in the range $7.00 \times 10^{-3} \sim 4.955 \times 10^{3}$ mm Hg.
9	843	-	1966	298.2			77.8	22.2	Similar to the above specimen; measured in nitrogen at 1 atm.

DATA TAPLE NO. 434 THERMAL CONDUCTIVITY OF [URANIUM + URNAIUM DIOXIDE] ALLOYS

($U + UO_2$ > 99.50%; impurity ≤ 0.20% each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.00415

p(mm Hg)	k
CURVE 2* T = 298.2	
0.0168	0.0000502
0.0603	0.000105
4.17	0.000527
25.1	0.00145
61.7	0.00188
207	0.00243
1245	0.00289
3467	0.00301
5433	0.00301

T	k
CURVE 3*	
298.2	0.00390

p(mm Hg)	k
CURVE 4* T = 298.2	
0.00700	0.000105
2.57	0.000481
46.8	0.00155
513	0.00247
2985	0.00269
4842	0.00272

T	k
CURVE 5*	
298.2	0.00326

p(mm Hg)	k
CURVE 6* T = 298.2	
0.00403	0.000109
0.100	0.000117
2.37	0.000326
20.9	0.00108
135	0.00176
776	0.00218
1303	0.00226
5370	0.00235

T	k
CURVE 7*	
298.2	0.00314

p(mm Hg)	k
CURVE 8* T = 298.2	
0.00700	0.0000669
0.912	0.000112
2.07	0.000280
45.7	0.00103
180	0.00151
724	0.00185
1202	0.00206
2884	0.00215
4955	0.00218

T	k
CURVE 9*	
298.2	0.00205

* No graphical presentation

SPECIFICATION TABLE NO. 435 THERMAL CONDUCTIVITY OF [ZIRCONIUM + ZIRCONIUM DIOXIDE] ALLOYS

($Zr + ZrO_2 > 99.50\%$; impurity $\leq 0.20\%$ each)

Curve No.	Ref. No.	Method Used	Year	Temp. Range, K	Reported Error, %	Name and Specimen Designation	Composition (weight percent) Zr	ZrO_2	Composition (continued), Specifications and Remarks
1	843	-	1966	298.2			84.4	15.6	Powder specimen contained in a 0.75 in. dia x 2 in. long stainless steel cylindrical cell; mesh size -70 +80; thermal conductivity measured by using the transient line source method, the heat source was a 36-gauge constantan wire contained in a 0.025 in. O.D. hypodermic tube soldered along the axis of the cylindrical cell; data calculated from measured line temperatures at two certain times, measured in nitrogen at 1 atm.

DATA TABLE NO. 435 THERMAL CONDUCTIVITY OF [ZIRCONIUM + ZIRCONIUM DIOXIDE] ALLOYS

($Zr + ZrO_2 > 99.50\%$; impurity $\leq 0.20\%$ each)

[Temperature, T, K; Thermal Conductivity, k, Watt $cm^{-1}K^{-1}$]

T	k
CURVE 1*	
298.2	0.00293

* No graphical presentation

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